final environmental impact statement

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

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OF THE INTERIOR

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LAND MANAGEMENT

CRUDE OIL TRANSPORTATION SYSTEM: VALDEZ, ALASKA TO MIDLAND, TEXAS

(AS PROPOSED BY SOHIO TRANSPORTATION COMPANY)

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DESCRIPTION OF THE ENVIRONMENT
VOLUME II

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ENVIRONMENTAL STATEMENT

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CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

Volume II

Prepared by

Bureau of Land Management
U.S. Department of the Interior

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DESCRIPTION OF THE ENVIRONMENT

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2.1.9 Cultural resources

Cultural resources, resources of historical, paleontological, or archaeological significance, are fragile, limited, and nonrenewable portions of the human environment.

2.1.9.1 Historical

Southern California overview. The postcontact history of the right-of-way area goes back to the 1540 reconnaissance by Alarcon along the lower Colorado River (Wildesen, 1974). Subsequent Spanish expeditions led by Friar Garces traversed the area between the San Jacinto Mountains and the river in 1771 (Beck and Haase, 1974). During the mid-1770s, the Spanish were seeking inland routes to Monterey, which led Juan Bautista de Anza through what is now Riverside County and developed the first Spanish-Cahuilla contact (Bean and Lawton, 1975).

Trapping was practiced by Anglo settlers along the lower Colorado River shores around 1800. During the 1840s and 1850s the Emigrant Trail ran along the west base of the San Jacinto Mountains, providing a main route into California. The massive population influx stimulated by the discovery of gold in the north had resulted in increased settlement of the south as well. Stage operations through San Gabriel Pass were initiated in the 1860s, and continued until the arrival of the railroads in 1876 (State of California, 1975). Although population growth had centered in the north previously, the 1880s signaled, for southern California, the most extended period of sustained growth ever experienced by any equally compact region of the

United States (Lavendar, 1972). Spurred by improvements in transportation, real estate, and water development, the San Gabriel Valley became one center for much of this activity. After the turn of the century, additional growth was spurred by the emergent citrus industry, discovery of petroleum, and development of harbors and shipping. In more recent times much of the area through which the pipeline is proposed to pass has become a major transportation and utility corridor, while various adjacent areas have been and are being used for mining, military, agricultural, and recreation purposes.

Summary by location

Port of Long Beach and terminal area. The following is taken from an historical survey of the study area that is being prepared by the California State University at Los Angeles under the direction of Dr. Martin Shiesl at the request of the Corps of Engineers.

Pier J - Los Angeles River-Rio Hondo. The site of a battle (8 January 1847) between the United States and Mexican military forces is located near the project area. This decisive American victory, known as the Battle of San Gabriel River, ended the California phase of the war with Mexico, resulting in the transfer of California from Mexico to the United States (Treaty of Guadalupe Hidalgo, 1848). The battle took place along the then San Gabriel River, now the Rio Hondo channel, between modern Washington and Whittier Boulevards. The Americans, approaching from the southeast, crossed the river at a ford (later called Pico Crossing) close to where Pico Mansion now stands. The battle site was along the river near the intersection of Bluff Road and the Union Pacific Railroad tracks in Montebello. No other sites were discovered in the immediate project area.

Whittier Narrows. After centuries of Indian occupation, Whittier Narrows was first reached by Europeans in July, 1769 when a Spanish exploring party led by Captain Gaspar de Portola passed through en route from San Diego to

Monterey. Two years later the Franciscan Mission of San Gabriel was built along the river on the west side of Whittier Narrows. After Mexican secularization of missions in 1836, Whittier Narrows lands passed to William Workman, with a small part later to Pio Pico. Workman transferred much of the land to his son-in-law, Francis P. F. Temple, and his ranch boss, Juan Matias Sanchez. In the 1870s Elias J. (Lucky) Baldwin took over all but a few acres retained by Temple's widow, and grazed livestock there. By 1900 much land was sold off in small parcels devoted to walnut growing, truck farming, and dairying. Several small communities sprang up, notably Temple Corners and Garvey Acres. With the 1917 oil strike, a small settlement of oil workers grew on the Narrows' west side. Devastating floods had been frequent, leading in time to the building of the Whittier Narrows flood control works.

San Jose Creek. A grist mill, built by pioneer William Workman of Rancho La Puente in 1845, was operated for many years at a site on San Jose Creek close to Workman Mill Road. In the 1870s, the mill passed to E. J. Baldwin and later to Gaetano Castino, who lived at 1940 Workman Mill Road.

Site specific record. The following inventory of the historical resources was compiled from existing records gathered from all sources known to be holding such archives, without field survey. The area of research comprised a strip 5 miles wide and approximately 250 miles long centered on the proposed pipeline route.

The 25 historical landmarks tabulated in Table 2.1.9.1-1 include 10 localities listed in the National Register of Historic Places and 18 California State Historical Landmarks. Three of these entries appear on both lists accounting for the apparent discrepancy in the total.

Table 2.1.9.1-1

National Register Listings and State Historic Landmarks in California

USGS QUAD MAP	Designation	Location
	National Register of Historic Places	
7.5 San Pedro	Point Fermin Lighthouse	805 Paseo Del Mar, San Pedro
7.5 Long Beach	Los Cerritos Ranch	4600 Virginia Rd., Long Beach
7.5 South Gate	Lynwood Pacific Depot	11453 Long Beach Blvd., Lynwood
7.5 San Pedro	Battery Osgood-Farely	Fort MacArthur Upper Reservation San Pedro
7.5 Whittier	Pio Pico Casa	6003 Pioneer Blvd., Whittier
7.5 Baldwin Park	Temple Mansion	15415 E. Don Julian Rd., City of Industry
	Workman Adobe	15415 E. Don Julian Rd., City of Industry
	Workman Cemetery	15415 E. Don Julian Rd., City of Industry
	John Rowland House	16021 E. Gale Ave., City of Industry
7.5 San Dimas	Casa Primera	1569 North Park Ave., Pomona
	Phillips Mansion	2640 W. Pomona Blvd., Pomona
7.5 Ontario	Palomares Adobe	Arrow Hwy. and Orange Grove Ave., Pomona
	California State Historical Landmarks	
7.5 San Pedro	#384 Timm's Point	San Pedro
7.5 Long Beach	#881 Site of Port Los Angeles long wharf	Port of Los Angeles
7.5 Long Beach	#894 S.S. Catalina	Port of Los Angeles
7.5 Long Beach	#152 Dominguez House	18127 S. Alameda, Compton
7.5 South Gate	#664 Heritage House	205 S. Willowbrook Ave., Compton
	#718 U.S. Air Meet	Wilmington Ave., Compton

Table 2.1.9.1-1 (Continued)

USGS QUAD MAP	Designation	Location
7.5 Whittier	#127 Pio Pico Casa	6003 Pioneer Blvd., Whittier
	#385 San Gabriel Battlefield	Washington Blvd. and Bluff Rd., Montebello
	#681 Paradox Tree	600-800 W. Whittier Blvd., Whittier
7.5 El Monte	#161 Mission Vieja	N. San Gabriel Blvd. and Lincoln Ave., Montebello
7.5 Baldwin Park	#874 Workman Home	15415 E. Don Julian Rd., City of Industry
7.5 San Dimas	#386 Casa de Carrion	919 Puddingstone Dr., La Verne
	#289 First Pomona College Building	W. 5th and S. White sts., Pomona
7.5 Ontario	#372 Palomares Adobe	491 E. Cucamonga Ave., Pomona
7.5 Fontana	#787 de Anza Crossing in 1775-1776	Near Union Pacific Bridge, Jurupa Heights, Rubidoux
7.5 San Bernardino South	#617 Fort Benson	E. of Colton, San Bernardino
	#121 Agua Mansa	3 mi. SW of Colton, San Bernardino
7.5 Redlands	#43 The Zanja	Bryn Mawr
	#95 Guachama Rancheria	Cottonwood Road, Bryn Mawr
	#42 San Bernardino Assistencia	Barton Road, Bryn Mawr
7.5 El Casco	#749 Sahatapa	San Timoteo Canyon near El Casco station of Southern Pacific

In addition, both counties and cities have been directed by Federal legislation to compile inventories of their historic structures and places, but progress has been uneven. Riverside County has 48 such landmarks, 12 of them within the proposed pipeline corridor. In San Bernardino County, a map

of such sites has been drafted in the County Parks Department, while the individual records are housed at the county museum. For Los Angeles County, the inventory has not yet been completed, and a complete listing of the county landmarks already adopted is only now being prepared (Barbara L. Wight, 1975, pers. comm.).

At both the state and county levels, there are additional lists of historic places of lesser significance usually designated as points of interest. The lists of county or municipal landmarks and points of interest are not up-to-date. Because their stage of completion is so uncertain, to indicate those sites already designated would place a disproportionate weight on those jurisdictions more advanced in their compliance.

The Federal and state landmarks span California's written history from the de Anza crossing of 1775 to the First International Air Meet in 1910. The county landmarks typically recognize more recent events, such as the marker of Riverside County in the Chuckwalla quadrangle (quad) near Desert Center commemorating the military training operation under the command of General George S. Patton from 1942-1944.

Pipeline route

Redlands to Indio Pump Station. Only one historic site is recorded within this segment. The Indian village of Sahatapa is located in San Timoteo Canyon near the El Casco railroad station. Sahatapa is currently designated as one of the California State Historical Landmarks.

Indio to Desert Center Pump Station. Known historical resources for this segment include Camp Young, a Riverside County historical landmark. Various historic mining localities exist within this portion of the corridor and are concentrated in the Chuckwalla Mountains. No other officially designated sites are known to exist.

Desert Center to Ehrenberg Pump Station. Mining activities were concentrated in the Chuckwalla, Mule, and McCoy mountains along this segment. The original historic townsites of Ehrenberg and La Paz were situated along the east bank of the Colorado River but are presently under water.

Ehrenberg to Livingston Pump Station. Three historical sites are recorded along this short section. They include the Hi Henry Mine at Kofa Butte and the original townsite of Kofa. Also situated within the corridor is the Copper Bottom Mine within the Cunningham Mountains.

Livingston to Eagletail Mountains area. There are few known historical sites within this segment of the corridor. While the historic review of this section is incomplete, a number of wells (e.g., Indian Well) and mines occur within the corridor.

Eagletail Mountains area to Gila Pump Station. The only recorded historic location available in the literature reviewed is the Southern Pacific Railroad. This route also crosses other segments. The historic railroad stop of Gillespie occurs within the corridor.

Gila to Casa Grande Pump Station. There are no known historical sites within this segment of the corridor except the Southern Pacific Railroad route and the railroad stop, Mobile (status unknown).

Casa Grande to Coolidge Pump Station. Two historical sites currently on the National Register of Historic Places are recorded in this segment. They include the Casa Grande Women's Club building, and the historic town of Vekol. The historic railroad stop, Bon, also is located within the corridor.

Coolidge to Black Mountain Pump Station. The only known historical site located in this short segment is the Tom Mix Monument, located along the Pinal-Pioneer Parkway.

Black Mountain to Redington Pump Station. Along this segment, two historical sites are recorded. These sites are the town of Redington and the Soza Ranch.

In 1784, the Spanish explorer Allande traveled from Mexico to Tucson, crossing the San Pedro River just west of the proposed Redington Pump Station (see Figure 2.1.9.1-1).

Redington to Cochise Pump Station. Fifteen historic sites and a portion of the historic route of Allande's 1781 expedition are contained in this historically rich segment. Historic sites include: Apache Pass historic vicinity, Apache Pass Stage Station, Coronado National Monument, Duncan Hotel, Fort Bowie, Gilman Headquarters, Iron Front Store, John H. Norton Commercial Company, Peck House, Russellville, Schwertner/Nordaus House, Stulis' Stage Station, Willcox Bank and Trust Building, the Willcox Lumber Yard, and Hookers Hot Springs (Table 2.1.9.1-2).

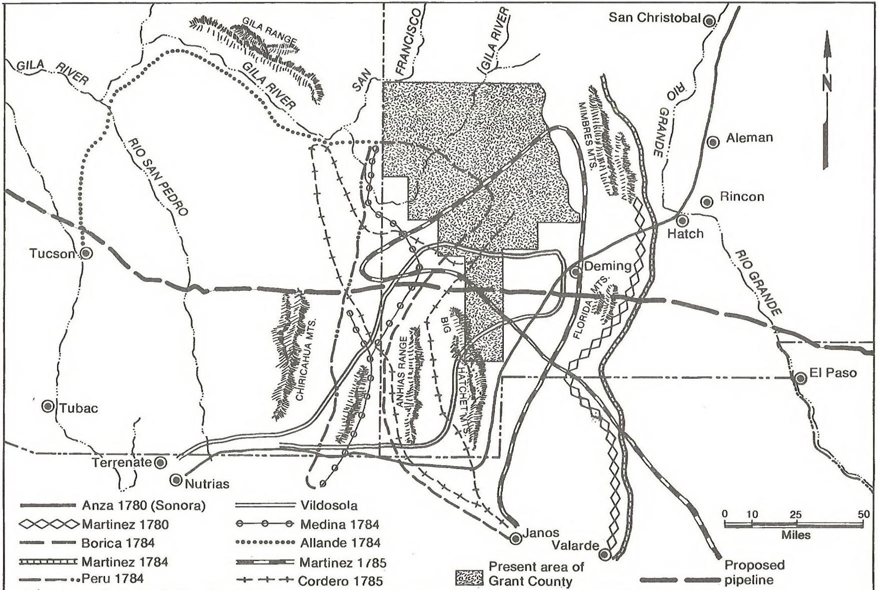


Figure 2.1.9.1-1 Spanish exploration over Grant County territory 1780-1785

Table 2.1.9.1-2

Known Historical and Cultural Sites Within

10 Miles of Pipeline Route in Arizona

SITE	County
Apache Pass, Fort Bowie National Historic Site vicinity	Cochise
Apache Pass Stage Station Site, Fort Bowie National Historic Site vicinity	Cochise
Coronado National Memorial	Cochise
Dos Cabezas, Willcox vicinity	Cochise
Duncan Hotel, 138 S. Railroad Avenue, Willcox	Cochise
Fort Bowie National Historic Site	Cochise
Garden Canyon Petroglyphs	Cochise
Gillman Headquarters, Willcox vicinity	Cochise
Hilltop, San Simon vicinity	Cochise
Iron Front Store, 108 N. Railroad Avenue, Willcox	Cochise
John H. Norton Commercial Company, Railroad Avenue and Stewart, Willcox	Cochise
Peck House, 137 S. Railroad Avenue, Willcox	Cochise
Russellville, Willcox vicinity	Cochise
San Simon Village site, 10 miles west of Bowie	Cochise
Schwertner-Nordaus House, E. Stewart, Willcox	Cochise
Steele's Stage Station Site, Willcox vicinity	Cochise
Willcox Bank and Trust Building, 114 N. Railroad Avenue	Cochise
Willcox Lumber Yard, 200 N. Railroad Avenue	Cochise
Soza Ranch, Redington vicinity	Pima

Source: Williams Brothers, 1976.

Table 2.1.9.1-2 (Continued)

SITE	County
American Flag Ranch Headquarters, Oracle vicinity	Pinal
Casa Grande Ruins National Monument	Pinal
Casa Grande Women's Club Building, 407 N. Sacaton, Casa Grande	Pinal
Copper Creek, Mammoth vicinity	Pinal
Flieger Site, Oracle vicinity	Pinal
Tiger, Mammoth vicinity	Pinal
Tom Mix Wash, Pinal-Pioneer Parkway	Pinal
Vekol, Casa Grande vicinity	Pinal
Ehrenberg	Yuma
Hi Henry Mine, Kofa Butte	Yuma
Kofa	Yuma
Ripley Intaglios, Ehrenberg vicinity	Yuma

Cochise to Lordsburg Pump Station. Two known historic sites are located within this segment. They are the ghost town of Shakespeare and the Shakespeare Cemetery (Table 2.1.9.1-3). A portion of the Butterfield Stage Route and the routes of Spanish Explorers Martinez (1785), Medina (1784), and Cordero (1785) also crossed through this segment (Figure 2.1.9.1-1).

Lordsburg to Deming Pump Station. The Deming courthouse constitutes the only recorded historic site within this segment. Portions of the Morman Battalion Trail, Butterfield Overland Mail Route, and the routes of Spanish explorers Anza, Cordero, Borica, and Martinez also crossed through this segment (Figure 2.1.9.1-1).

Deming to Anthony Pump Station. In this segment, known historical sites include the International Boundary Marker No.1, Camino Real portions of the Santa Fe to El Paso Stage Route. The routes of Spanish explorers Anza

(1780), Martinez (1780), and Martinez (1784) also cross through this segment (Figure 2.1.9.1-1).

Table 2.1.9.1-3

Known Historical and Cultural Sites

Within 10 Miles of Pipeline Route in New Mexico

SITE	County
Shakespeare Cemetery	Hidalgo
Shakespeare (ghost town)	Hidalgo
1910 Luna County Courthouse and Park, Deming	Luna
Butterfield Overland Mail Route	Hidalgo, Grant, Luna, & Dona Ana
International Boundary Marker No.1	Dona Ana
Camino Real	Dona Ana
Santa Fe to El Paso Stage Route	Dona Ana
Pecos River Route	Eddy

Source: Williams Brothers, 1976.

Anthony to El Paso Pump Station. A portion of the Pecos River Stage Route is the only known historical resource within this segment.

El Paso to Guadalupe Pump Station. There are no known historical sites or routes within this segment. The exact status of the historic towns of Salt Flat and Cornudas is unknown.

Guadalupe to Pecos River Pump Station. Three known historic sites are associated with this segment. They are Guadalupe Mountain National Park, Pinery Station (Butterfield Stage) and the Wallace Pratt Lodge.

Pecos to Jal. The known data base for this segment includes two historic sites and five aboriginal sites. Pope's Wells historic site (two separate locations) is on the State Historical Register and has been nominated to the National Register of Historic Places. Both wells are located approximately 2 miles from either side of the existing pipeline proposed for conversion.

Jal to Midland terminal. There are 18 known historical sites within this final segment, 15 of which are located in Midland, Texas, and 3 in Odessa, Texas (Table 2.1.9.1-4).

Table 2.1.9.1-4

Known Historical and Cultural Sites

Within 10 Miles of Pipeline Route in Texas

SITE	County
Baker Ranch School, 10 miles north of Odessa on U.S. Route 385	Ector
Barrow Ranch House, 8 miles north of Odessa on U.S. Route 385 and 5 miles west	Ector
Notrees Historical Marker, Notrees	Ector
Dorsey Home, 213 N. Weatherford, Midland	Midland
First Methodist Church, 305 N. Main Street, Midland	Midland
Greenwood Baptist Church, 12 miles southeast of Midland on Texas 158	Midland
John Valentine Pliska, Texas Avenue and Baird Street, Midland	Midland
Lawrence Home, 1017 Loraine, Midland	Midland
Marcy Trail, 1.9 miles east of Midland on U.S. Route 80	Midland
Midland & Northwestern Railroad, 1 mile east of junction of Field Marker 1788 and Texas 158	Midland
Midland Christian College, Ulmer Park, Midland	Midland
Midland County, Courthouse Lawn, Midland	Midland
Midland County's First Producing Oil Well, Texas 158, 10 miles southeast of Midland	Midland
Midland County's First Water Well, Missouri & Baird, Midland	Midland
Midland Man, Courthouse grounds, Midland	Midland
Scharbauer Hotel, 111 S. Main, Midland	Midland
Site of Old Army Flying School, Air Terminal, Midland	Midland

Source: Williams Brothers, 1976.

Table 2.1.9.1-4 (Continued)

SITE	County
Staked Plains, 219 N. Main, Midland	Midland
W.B. Anglin, Mabee Ranch, northwest of Midland	Midland
W.F. Scarborough Home, 802 S. Main, Midland	Midland
Hueco Tanks State Park	El Paso
Guadalupe National Monument	Culberson
Pinery Station (Butterfield Stage)	Culberson
Wallace Pratt Lodge	Culberson

2.1.9.2 Paleontological

The area in and around Los Angeles and Long Beach harbors contains "the greatest sequencing of lower and upper Pleistocene marine invertebrate fauna in western North America" (Soule and Oguri, 1975). Although there presently is no single detailed geologic map of the Long Beach area, extensive deposits of Quaternary alluvium are mapped in the ancient Los Angeles River channel. Cross sections, based on oil- and water-well data, serve to reveal the stratigraphy, and there are fossiliferous sediments present in surface outcrops. Fauna have been recovered and identified from Upper and Lower Pleistocene and Upper and Lower Pliocene and Miocene in a variety of formations. Molluscan species are predominant, although arthropods, ostracods, teleost fishes, avian and other vertebrate species are present. Foraminifera, bryozoans, algae, and other fossil plants have also been identified.

In the interior, most of the known fossils consist of mammals recovered from late Pliocene fluviatile and lacustrine sediments. Included in the fauna are mastodon, _Rhynocotherium_ spp.; dog, _Canidae_; cat, _Felidae_; bear, _Agriotherium_ spp.; bear, _Plionarctos_ spp.; peccary, _Prosthennops_; ground

sloths, Megalonychidae; camels, Camelidae; deer, Palaeomerycidae; pronghorns, Antilocapridae; raccoons, Procyonidae; and wolverines, Mustellidae.

A total of 34 previously recorded paleontological localities are tabulated by location and designation in Table 2.1.9.2-1.

Table 2.1.9.2-1

Recorded Paleontological Resources in California

USGS QUAD MAP	Designation		Location
7.5 Long Beach	LACM	873A	S of Victoria St., W ca 1,600 ft from Del Amo Jr. Seminary, L.A. County
	LACM	894E	W of Susana Rd., S of Victoria St., bet. Ana and Maria sts., L.A. County
	LACM	894F	Same as above
	LACM	3319	Intersection Del Amo Blvd. and Alameda St., City of Carson
	LACM	3660	Intersection Pixie and Cover sts., Lakewood
	LACM	1919	Ca 1,000 ft SW of intersection of San Diego Freeway and Wilmington Ave.
	LACM	6802	Bixby Ave., bounded on W by Atlantic Ave. and on E by Brayton Ave.
	LACM	3245	1,000 ft SE of San Diego Freeway and Cherry Ave., Long Beach Mun. Airport
	LACM	1165	Intersection Sepulveda Blvd. and Alameda St., City of Carson
	LACM	1932	Intersection San Diego Freeway and Spring St., Long Beach
	LACM	3260	General Long Beach location
	LACM	3550	Corner Pine Ave. and 12th St., Long Beach
	LACM	1163	Henry Ford Ave. and Anaheim St., L.A. County
	LACM	1144	Corner Magnolia and 11th St., Long Beach
	LACM	6896	Magnolia and Ocean Blvd., Long Beach
	LACM	1005	Bixby Park near Junipero Ave. and Ocean Blvd., Long Beach
	LACM	1022	Orange Ave. and Spring St., Signal Hill
	LACMIP	2668	I-405 W of Cherry Ave., Long Beach
	LACMIP	423	Intersection I-405 and Cherry Ave., Long Beach
	USGS-M	2011	Cherry Ave. at top of Signal Hill, Signal Hill
	UCMP	2116	Signal Hill or Cerritos
	CIT LOC	1348	Projected intersection Raymond Ave. and Hill St., Signal Hill

Table 2.1.9.2-1 (Continued)

USGS QUAD MAP	Designation		Location
	LACMIP	424	Near intersection I-405 and Atlantic Ave., Long Beach/Signal Hill
7.5 South Gate	LACM	3382	Adjacent RR tracks S of 600 block Carob St., Compton
7.5 La Habra	LACM	6908	Knoll and streambed W of Los Palacios Dr., City of Industry
	LACM	6907	Same as above
7.5 San Dimas	LACM	3331	General location, San Jose and Puente Hills
	LACM	3330	R. 9 W., T. 1 S., general location
	LACM	1147	San Jose Hills, SE Buzzard Peak
7.5 El Casco	LACM	1336A	T. 2 S., R. 2 W.
	LACM	1335A	T. 3 S., R. 2 W.
	LACM	1334A	T. 3 S., R. 2 W.
7.5 Beaumont	LACM	1016	T. 3 S., R. 1 W.
	LACM	6596	T. 3 S., R. 1 W.
	"OC Ranch"		T. 3 S., R. 1 W.

In addition, other areas within the study corridor appear to have the potential for paleontological discoveries. The Badlands, covered by portions of the San Bernardino south, Redlands, El Casco, and Beaumont USGS topographic quad maps, is a classic fossiliferous locality with late Pliocene and early Pleistocene continental deposits (G. Jefferson, pers. comms., 12 December 1975, Natural History Museum, Los Angeles County). The area is referred to as the Bautista formation in the more westerly portion, and the Mount Eden formation toward the east. In the Desert Hot Springs quad, there are invertebrate fossil deposits which have been reported by Lasby and Allen (1954), but site sheets are not available. Additional locations are covered by the Indio Hills, Lost Horse Mountain, and Indio quads. The entire region of Mecca Hills, shown on the Thermal Canyon and Cottonwood Springs quads, is potentially fossiliferous. Potential deposits,

also based upon geologic formations, occur around what appear to be gravel beds on the Ripley quad (G. Jefferson, pers. comm., 12 December 1975, Natural History Museum, Los Angeles County).

Many sedimentary beds are transected by the proposed pipeline in Arizona, New Mexico, and Texas. In particular, the Pecos River area is reported to contain many vertebrate fossil deposits including mammoth, bison, turtle, and camel fossils. It is likely, therefore, that a number of these beds contain fossiliferous sediments, with potential paleontological localities. However, until specific overviews and field assessments are completed, a full account of important locations and potential impacts is unobtainable.

2.1.9.3 Archaeological

Historical record (Port area)

The literature search disclosed four ethnographically known village sites in the vicinity of the study area, but not within the project area. No archaeological sites on or eligible for inclusion on the National Register of Historic Places were identified in the project area.

General discussion, pipeline route

The areas within the boundaries of this project vary greatly in elevation, slope, vegetation, fauna, hydrology, geology, climate, and all other environmental factors which influenced human occupation. Since the inception of human occupation, many of these variables have changed. It is predictable that there would be different adaptions or adjustments to the environment even within a region, both through time and at any one time.

The prehistory of the southern part of the Southwest is closely related to the general aridity of the desert environment which covers most of the area. Water, vital to life and other resources, is and has been at various times a

relatively scarce commodity. Except for the immediate Pacific coastal area, the average annual desert rainfall is normally between 4 and 12 inches. The cultural history of the Southwest corresponds closely to the availability of water within the various environments. Consequently, where water resources were meager, archaeological and historical remains are likewise often meager. Conversely, in areas where water resources are dependable (e.g., the Salt River Valley of Arizona and Rio Grande of New Mexico) archaeological and historical remains are relatively abundant. However, the two factors are not absolutely directly proportional.

Few arid areas in the world demonstrate such a substantial past environmental and cultural diversity over such a long period as does the Southwest desert. As such, the corridor offers an excellent field laboratory in the form of an east-west transect of the Southwest desert for the study of man's environmental interaction through all known periods of desert prehistory (see Figure 2.1.9.3-1).

Anticipated cultural resources

Knowledge about the archaeological resources within the subject corridor varies substantially. Extremely limited information is available for many areas, because only a small portion of the desert has been subject to any form of archaeological reconnaissance, and even a smaller portion has been intensively surveyed for archaeological resources. Until more systematic archaeological fieldwork is conducted, this lack of specific information for a large portion of the desert permits only an intuitive assessment for predicting and evaluating archaeological resources.

Archaeological sites vary from the faint traces of early hunters and gatherers who lived in the desert of the Southwest 10,000 or more years ago, leaving their artifacts and other tangible remains in fragile scatters in the desert pavement, to extensive complexes of villages, camp sites, gathering and processing stations, and ceremonial sites. The latter were

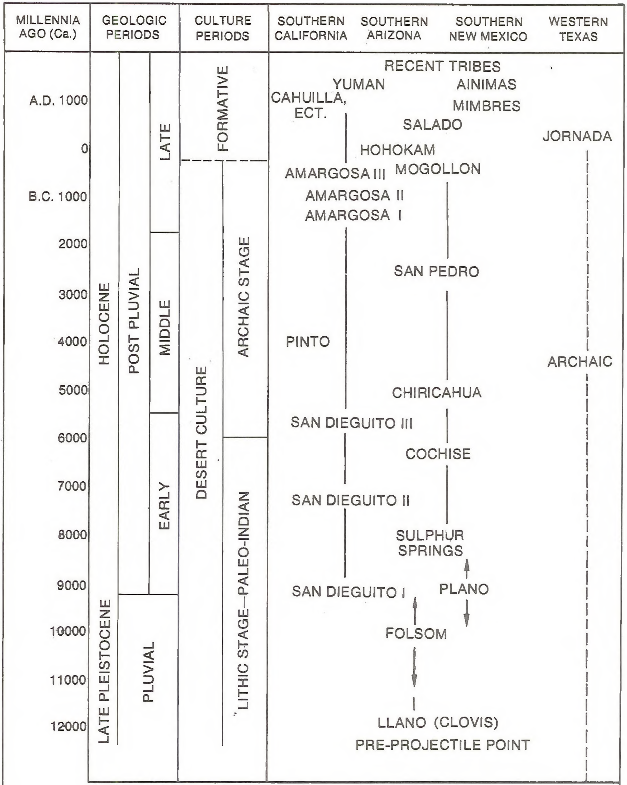


Figure 2.1.9.3-1 Southern Southwest desert culture sequence

linked by elaborate trail systems of the desert's late prehistoric inhabitants.

Cultural resources, including both archaeological and historical sites, are defined as: all physical remains of natural or cultural origin which contain evidences of, or information about, past human activity. These include life processes or cultural chronology, and those fragile and non-renewable remains of human endeavor as reflected in sites, areas, districts, structures, features, artifacts, objects, ruins, works of art, architecture, and natural features that were of importance in human events or documentation. Cultural resources are commonly discussed in terms of their prehistorical and historical value. Each portion of the resource represents a part of a continuum of events from the earliest evidences of man to the present.

To facilitate discussion, the archaeological sites of the Southwest desert can be separated into several categories.

Occupation sites. This site type represents long-term or seasonal villages or base camps. Base camps were the center of nearly every economic or social activity. California archaeological materials expected at these sites are house rings, sleeping circles, rock shelters, storage pits, cooking hearths, a wide range of tools, scattered potsherds, and a moderate to heavy amount of chippage waste. Added to this inventory in Arizona and New Mexico, and to some degree in Texas, are large village complexes with a wide inventory of permanent house or village structural remains, such as pit houses, masonry structures, and multiroom pueblos.

In short, they contain practically the full range of aboriginal remains. Many of these sites contain midden deposits, culturally altered soil, the result of extensive human occupation. Since sites of this type are usually large and contain a wide variety of cultural items and cultural features, they are easily recognized by relic collectors and pot hunters. This has

made them open targets for vandalism and destruction. These sites are also limited in number and represent the focal point around which the major cultural activities centered.

<u>Processing or special use sites</u>. These sites represent loci of specific activities that were carried out by the desert's aboriginal populations. These sites include seed-grinding stations, bedrock mortar complexes, roasting pits, cache sites, temporary campsites, fish traps, hunting blinds, quarries, rock shelters, etc. Individually, they may be interesting only as cultural items and/or for cultural features which they contain. Collectively, however, they are very significant, especially if they can be linked with a particular base camp from which these specific activities were generated. They then become very important in the study of settlement/subsistence patterns of the past cultures. Also, since these sites are normally relatively small, they are extremely vulnerable, both directly and indirectly, to any impact activity.

<u>Rock art sites</u>. Petroglyphs and pictographs make up this site type. Petroglyphs and pictographs are pecked and painted pictures of animals, men, mythical beings, or geometric and abstract designs. These are usually found on exposed, flat-rock surfaces in the open air or on the walls of rock shelters and occasionally on caves throughout the desert. Some of the world's greatest densities of petroglyphs and pictographs are contained in the California and Southwest deserts. Unfortunately, these have become the objects of vandalism and destructive acts that are the apparent result of increased public use and abuse.

<u>Intaglios</u>. This unique art form is limited to the extreme western Arizona and California deserts and is comprised of large figures of animals, humans, and geometric forms made in the desert pavements. These cultural features have been reported along the lower Colorado River and in the Yuman Desert. They are extremely fragile and the disturbance of their desert pavement

environment could result in their complete loss. Rock alignments and other unusual surface features can also be included under this site type.

Trails. Portions of ancient aboriginal trails are still present throughout the desert. These remnants may include poorly defined portions that are marked only by a few broken pottery shards or well preserved trail segments more than 2 miles long. Some are clearly visible in the desert pavement with trail markers, petroglyphs, and sleeping circles along the way. Trails are extremely vulnerable to direct construction impacts.

Cemeteries or burials. Prehistoric Indian cemeteries, burials, cremations, and mourning-ceremony sites make up this type. Burial sites range from isolated burials in shallow holes to extensive cemeteries.

Ceramic shard scatters. This site type can range from the remains of a broken olla or pottery vessel to an extensive surface scatter of pottery or ceramic ware. These sites are fairly common throughout the desert. They may contain a few other cultural items, but the predominant ones are pottery shards. These sites are usually represented almost totally by surface material.

Flake scatters. This site type is also fairly common in the desert. Sites of this type consist of scattered chippage waste of flaking material such as chalcedony, chert, jasper, rhyolite, or obsidian. Like the ceramic shard scatters, these sites consist almost exclusively of surface material and therefore are extremely fragile. Also, like the special-use sites, when flake scatters can be tied in with the settlement/subsistence pattern of a particular area, their significance becomes even greater.

Much of the material presented in the cultural and paleontological sections was gathered from personal contacts and those sources appearing in the references. The most significant references used are Williams Brothers' Environmental Services Impact Assessment (1976), Roberta Greenwood (1975),

Ann Loose (1976), Agency for Conservation Archaeology, Eastern New Mexico University (1976), Arizona State Museum (1976), and Jelks, (1960).

Historical record, pipeline route

Early Man Period. From a growing body of archaeological data, it is now clear that by 12,000 B.P. (before present) most of the New World or Western Hemisphere was at least thinly populated by bands of people who had originally crossed over the Bering Straits from the Old World. The actual antiquity of humans in the Southwest is uncertain, but may reach 20,000 B.P. if the dates for the Yuha Man burial (Imperial County, southern California), and the Midland burial (near Midland, Texas) are correct. Other estimates have been reported as early as 29,750 B.P. and even 40,000 B.P. Some other site dates in the Americas correspond to this early date. All, however, are controversial.

Some archaeologists have ascribed cultures of this period to a Lithic Stage, or a "preprojectile point" stage. Within the low deserts of California and Arizona, an industry of crudely flaked stone tools of this period has been designated "Malpais."

Paleo-Indian Period (circa 12,000 to 8,000 B.P.). Remains of Paleo-Indian culture in the southwestern United States are firmly dated at approximately 12,000 to 13,000 years ago. This period in the Southwest lasted from circa 12,000 to 8,000 B.P. Tremendous climatic changes occurred during this time period and influenced cultural activities.

Subsistence focused on the exploitation of large migratory herbivores, including the now extinct Pleistocene fauna of mammoth, bison, dire wolf, horse, and camel, with plants important but apparently secondary. The major well-defined cultural traditions of this period are the Clovis and Folsom, named after sites in eastern New Mexico where they were first identified. These two traditions are characterized by two distinctive types of fluted

projectile points used for large-game kills. Well-known sites in the region of the corridor include, but are not limited to, (1) Blackwater Draw in eastern New Mexico and (2) Naco, Lehner, and Murray springs of the San Pedro River valley, southern Arizona. Nearly all such sites are located in Pleistocene-age marsh areas, or near relict lakeshores of the same age.

In recent years it has become apparent that a comparable stage was widespread throughout California and adjoining areas. This has been designated San Dieguito, (Figure 2.1.9.3-2) and is probably a part of the Western Pluvial Lakes Tradition. Many Clovis-Folsom or San Dieguito sites remain undiscovered in the subject corridor region because of the extensive remains of Pleistocene marshes and lakes and other important features common to the southern part of the Southwest.

The Archaic Stage (circa 8,000 B.P. to A.D. 1). With the termination of the Pleistocene, most of the major big-game animals became extinct, forcing Archaic peoples to adopt new subsistence patterns. The big-game hunting economy was gradually replaced by the preagricultural hunting and gathering economy of the Archaic Stage which was also part of the desert culture. In southeastern Arizona and southwestern New Mexico, the replacement tradition became the Cochise culture; in southwestern Arizona and southern California it became perhaps the later aspects of the San Dieguito culture and certainly early Pinto-Little Lake. Archaic peoples are generally characterized by the hunting of modern species of animals and by a heavy reliance on gathering of wild plant foods. Milling stones used for processing plant foods were developed or elaborated on specific point types, such as Pinto and San Pedro, and tool kits characterize this stage.

The Cochise culture is characterized by a gradual evolution toward a semisedentary horticulture economy. Three defined phases of the Cochise culture are (1) the Sulphur Springs, (2) the Chiricahua, and (3) the San Pedro.

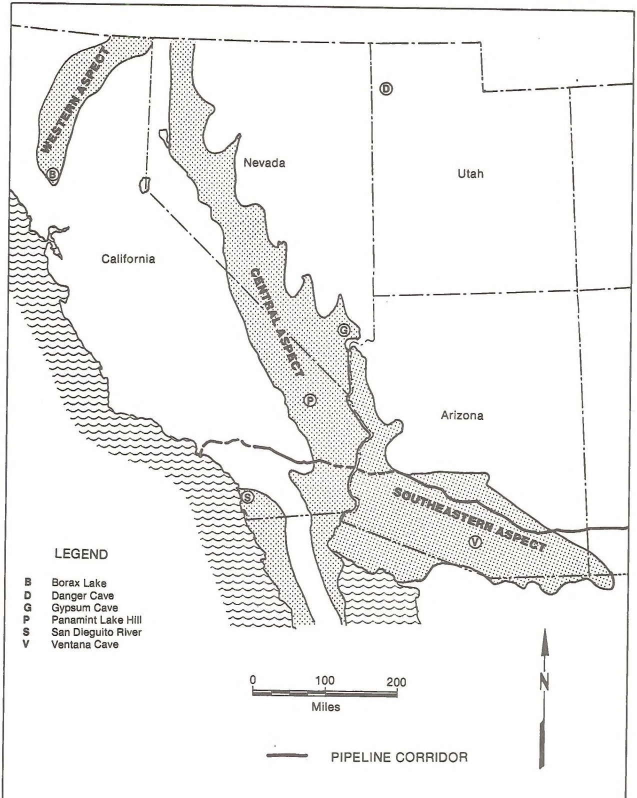


Figure 2.1.9.3-2 San Dieguito aspect boundaries

During each phase new technological innovations were added which were incipient to the later agricultural Mogollon culture which grew out of the last phase of Cochise culture.

To the west, the San Dieguito and later cultures of western Arizona and southern California extended into the historic with a hunting/gathering economy. Agriculture developed along the Colorado and peripheral areas in later times than to the east.

The Formative Period (circa 300 B.C. to 1350 A.D.). The Formative Period in the Southwest is characterized primarily by the technological introduction of agriculture, irrigation, ceramics, and permanent house structures from Mexico, approximately 300 to 100 B.C. The Desert-Archaic peoples gradually replaced wild-food gathering with domestic food production, particularly the crops of maize, beans, and squash.

The indigenous Cochise peoples were transitional to the Mogollon in southern New Mexico and southeastern Arizona. In south-central Arizona, an influx of peoples and/or cultural patterns from Mexico provided the stimulus for the rise of the Hohokam culture. The Amargosa tradition flourished in western Arizona and southeastern California until approximately 600 A.D. when it evolved into the agricultural Yuman tradition, which eventually centered on the lower Colorado River floodplain (Figure 2.1.9.3-3).

Post-European Contact Period. In southern California, the intrusion of northern Shoshonean peoples into the arid provinces occurred about 1,000 years ago. In the protohistoric period and years for which there is ethnographic evidence, the tribes present along the proposed pipeline corridor, from west to east, are the Gabrielino, Luiseno, Pass Cahuilla, Desert Cahuilla, Serrano, Chemehuevi (Northern Paiute), and Halchidhoma.

In Arizona, the Hohokam are generally believed to have become the Maricopa, Pima, and Papagos, while in eastern Arizona, New Mexico, and Texas, the

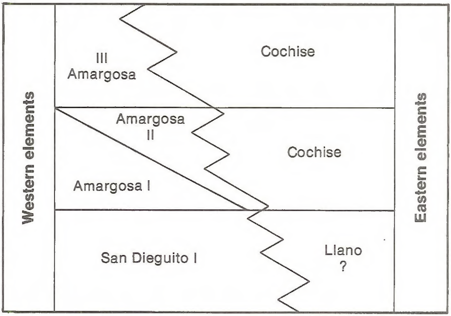


Figure 2.1.9.3-3 Relative dominance of western and eastern Desert Archaic elements at Ventana Cave

former indigenous Mogollon culture was replaced by various Athabascan tribes (primarily Apache) of northern origin.

Summary by location, pipeline route

Archaeological resources along the proposed corridor are both plentiful and diverse. A number of potential or known sites on the National Register of Historic Places list are within the corridor. Despite this assessment, very little of the proposed corridor has been systematically surveyed. To date, the only archaeological overview completed has been on the California section. A list of known archaeological resources in California is presented in Table A2.1.9.3-1 in Appendix A2.1.9.3.

Currently, overviews and field surveys are being conducted by Eastern New Mexico University and the Archaeological Research Unit of the University of California, Riverside. However, information gathered by these institutions cannot be included in this Environmental Statement because of time constraints. A number of documents and reports on cultural resource surveys within the subject states were researched in addition to personal contacts with researchers in the various states affected. Information from these sources has been incorporated where possible.

It cannot be overemphasized that no portion of the corridor or auxiliary facility location can be considered fully evaluated for cultural resources (archaeological or historical). Therefore, the following compilation of cultural resources must be viewed in this light. The disparity in existing data along the corridor must be recognized in the following discussion. Only the data on California come close to presenting the true picture of what has been recorded to date. It may eventually turn out that there are more cultural resources in each of the other states, although that fact is not reflected in this presentation. In many cases, archaeological sites were reported for a general area (broad reference to counties or USGS quad

maps only), but they cannot be assigned a location with respect to the study corridor.

The following compilation, therefore, is an unequal and incomplete listing of known cultural resources within the study area. Sites are listed in reference to pipeline segments or between pump stations, beginning with the Long Beach Terminal and ending with the Midland location. In many cases where site locations are known, the site type, temporal or cultural affiliation, components, assemblages, features, and other information are unknown.

Port of Long Beach to Dominguez Hills terminal. Two archaeological sites are known along this heavily urbanized segment. It is possible, although uncertain, that these sites have been destroyed. The likelihood of undisturbed sites in this segment appears fairly low.

Dominguez Hills terminal to Redlands Pump Station. At least five archaeological sites occur on the proposed pipeline route along this segment. An additional 31 are known to exist on or adjacent to the corridor. Several of these sites are concentrated in the Jurupa Hills and together appear to represent a potential National Register of Historic Places District. Other sites are concentrated in the Riverside area. However, urban expansion undoubtedly has caused some impacts. Site types for this region include villages, milling stations, pictographs, and task-related sites, most of which date to late prehistoric time.

Redlands to Indio Pump Station. This is perhaps the best documented area of the proposed route. At least 54 sites and two to four trails are reported here. Significant clusters occur in the Banning area, within the Indio Hills, and around Indio. Several probable or proposed National Register of Historic Places Districts are included.

The region around Indio, extending into the La Quinta, Indio, and Lost Horse Mountain quads, has been designated as one large site complex and was mapped as such. Fieldwork has not been initiated to define or delineate individual site boundaries within this greater site complex. Also on the Indio quad map, sites have been located in Coachella Valley by research persons but lack specific documentation. On the Sidewinder Well quad map, other areas have been surveyed and sites located which are presently being mapped and recorded. These sites include pottery and milling site scatters, cremation areas, villages, shrines, storage shelters, etc. The entire trail complex from San Bernardino past Indio to Blythe (RIv-53T) by itself is a potential National Register property.

As mentioned, the available data are not always consistent. In some instances a single dot on a map, or single site number, has been assigned to multiple, clustered sites. For example, RIv-241 on the Hayfield quad of the next segment is actually covered by San Bernardino County Museum individual site numbers 1257 through 1274. Similarly, a single dot on the McCoy Spring quad of the last California segment indicates numerous petroglyph and perhaps intaglio locations. Incomplete files of site sheets, mapping errors, and duplications of records by various institutions which have assigned their own series numbers have added to the problems involved in interpreting the data. However, the mere number of archaeological sites already known, their geographical distribution throughout the study area among diverse environmental settings, and the great variety of chronological and cultural descriptions are more than adequate to document and substantiate the wealth, abundance, and significance of heritage resources.

<u>Indio to Desert Center Pump Station</u>. Seven known sites occur along this segment, including those multiple sites previously mentioned. Of particular importance are the Hayfield petroglyphs, a proposed National Register of Historic Places District. In addition, two trail segments with associated pottery scatters and shrines are reported (probably part of RIv-53T). Several small lithic scatters have been reported for the area by crews

currently surveying in the region. No further details are available. Impacts here should be slight since an existing pipeline would be utilized. As nearly as can be determined, none of these sites is within the established pipeline corridor.

Desert Center to Ehrenberg Pump Station. More than 30 sites are reported along this segment including two or three within the proposed pipeline right-of-way. Particularly sensitive areas include Palen and Ford Dry lakes, the south end of the McCoy Mountains, the north end of Mule Mountains, and an area along the Colorado River, primarily on the Arizona side. Sites include scatters of pottery, milling stones and thermal fractured rock, cremations, trails, petroglyphs, rock circles, lithic scatters, intaglios, etc. Potential National Register of Historic Places sites include the sensitive areas previously mentioned.

Ehrenberg to Livingston Pump Station. Only one archaeological site is reported along this short stretch. Its relationship to the existing pipeline is unknown. Likewise, its significance cannot be assessed at this time. It seems likely that other sites would be present along the edge of the Dome Rock Mountains and along the old configuration of the Ehrenberg and Tyson washes.

Livingston to Eagletail Mountains area. No sites have been reported along this pipeline segment. However, because of the extensive environmental diversity in this stretch, especially near the New Water Mountains and along French Creek, numerous archaeological sites are predicted to exist.

Eagletail Mountains area to Gila Pump Station. No sites have been reported for this segment of the pipeline. As nearly as can be determined, this area of the Harquahala Plain is not rich in archaeological resources. Various transects of the area by archaeologists under the direction of Donald Weaver of Arizona State University revealed few sites. Those found occurred near the base of the mountains and included pottery scatters, lithic scatters and

several sleeping circles. One village has been reported by archaeologists of Arizona State University along the lower course of the Centennial Wash within the corridor. This village would appear to be of National Register quality.

Gila to Casa Grande Pump Station. Only one archaeological site is reported for this segment. This site is the Haley Hills site which appears eligible for the National Register of Historic Places. There can be little doubt that many other archaeological sites are present along this segment.

Casa Grande to Coolidge Pump Station. Five archaeological sites have been reported for this link which runs through the heartland of the Hohokam. Included within this corridor are the famous Casa Grande ruins, a national monument. Other major sites undoubtedly are present in this area.

Coolidge to Black Mountain Pump Station. Although no archaeological sites have been noted for this section, further investigation may uncover some.

Black Mountain to Redington Pump Station. This segment transects the San Pedro River valley. The famous Reeve and Davis ruins are located here. Other ruins and sites occur throughout this region. The Reeve and Davis ruins are of National Register caliber. The Flieger and Tiger sites also occur in the vicinity.

Redington to Cochise Pump Station. Only two archaeological sites are reported in data reviewed for this segment. This area, nonetheless, is rich in cultural expressions and exhibits archaeological sites ranging from at least Cochise times into the historic.

Cochise to Lordsburg Pump Station. At least three archaeological sites occur in this segment. These were temporary camp sites. It is likely that 10 times this number occur in the segment, based on extrapolation from data and subsequent surveys in other regions.

Lordsburg to Deming Pump Station. One potential National Register village site and seven temporary camp sites are known for this link. No further information will be available on the prehistoric resources along this segment until present surveys are completed.

Deming to Anthony Pump Sation. The only reported site for this link is a lithic scatter. However, with the presence of the Mimbres River and the Rio Grande, many sites of a diverse nature from many time periods or cultures can be predicted. Both river areas must be considered extremely sensitive from an archaeological point of view. The intervening area is only slightly less important.

Anthony to El Paso Pump Station. Six archaeological sites or districts are known in this area. Again, the eastern banks and terraces of the Rio Grande must be considered very sensitive. National Register or potential National Register properties identified include the Castner Range Archaeological District, the Fusselman Canyon Rock Art District, the Hotwell Archaeological Site, the Hueco Tanks Archaeological District with its famous rock art location, and the Northgate Site.

El Paso to Guadalupe Pump Station. The Hueco Tanks Archaeological District continues into this segment of the corridor. Incomplete information characterizes the remainder of this link. The extensive terrain covered by the segment most likely contains many archaeological sites, with some being quite early in time from an archaeological perspective.

Guadalupe to Pecos River Pump Station. No archaeological sites are noted for this segment. However, many sites can be predicted for this link, especially along the Delaware and Pecos rivers and along the foothills of and within the Guadalupe Mountains.

Pecos to Jal. Five archaeological sites are reported for this link, including a temporary camp and lithic scatter. No further information was available in several reports reviewed.

Jal to Midland terminal. Along this final link, 27 archaeological sites are known, including the famous Midland Man (sic-woman) site. Villages, 21 temporary camps, and one lithic scatter are included in the inventory. Probable National Register districts are present along this segment.

In summary, numerous archaeological sites are known along the corridor, although the record is very spotty and incomplete. Few of the reported sites along the route represent data from systematic surveys now underway in some areas. It would appear, based on a review of known sites and environmental variables, that hundreds of additional sites will be found within the study corridor. This estimation underscores the sensitivity of important cultural resources to large-scale projects such as the projected pipeline.

2.1.10 Visual resources

2.1.10.1 Visual resources -- Sea Leg and Port of Long Beach

Santa Catalina Island

Santa Catalina Island and the resort community of Avalon lie only 20 miles southwest of San Pedro Bay and 30 miles offshore of Orange County. The island and resort community are a popular destination for oceangoing powerboaters and sailboaters out of Los Angeles-Long Beach and Orange County marinas. With the exception of the resort community of Avalon and several rock quarries, the entire island is zoned for open space and is within a privately owned nature conservancy. The island's conservancy is open to public recreational use, including camping by permit, and is a valuable environmental education-scientific research area.

Nearshore, the ocean around Santa Catalina Island is a popular fishing and scuba/skin diving area and a valuable biologic reserve. Thus, the shoreline of Santa Catalina Island is of a high visual sensitivity. Furthermore, the island is highly visible in the background visibility zone from San Pedro Bay-Orange County coastline during fog-free winter months.

Light-colored rock quarries are significant visual intrusions on this otherwise subdued-colored idyllic island. The Pebbly Beach Quarry is close to the Avalon Resort. No blasting has occurred since 1971 although sufficient loose rock is available to have kept the quarry active on a small scale.

<u>Port of Long Beach</u>

San Pedro Bay, encompassing the Ports of Long Beach and Los Angeles, is not only a major deepwater commercial shipping harbor, but also an outstanding visual resource for the city of Long Beach and the greater Los Angeles urban area. The Port of Long Beach and the city of Long Beach have undertaken major projects to enhance the visual character of San Pedro Bay. See Figures 2.1.10.1-1 and 2.1.10.1-2, and Map 2.1.12-B (Attachment 1).

The shoreline of Long Beach from the mouth of the Los Angeles River flood control channel to Alamitos Bay is in public ownership and open to public recreational use. Many old landmark hotels and fine homes are located on the shoreline near downtown Long Beach; the Vichy Hotel is especially noteworthy. The city has built the Municipal Auditorium and Sports Arena and is now completing the Pacific Terrace Shoreline Park, with one of the goals being to improve the visual character of the shoreline near the downtown area. The Belmont Shores, Belmont Pier, and Naples portion of the shoreline is noted for its picturesque visual character. Oil rig islands in San Pedro Bay have been architecturally treated and landscaped to enhance rather than detract from the visual character of San Pedro Bay.

Figure 2.1.10.1-1 Pier J as viewed from Long Beach: Note Queen Mary and landscaped oil island

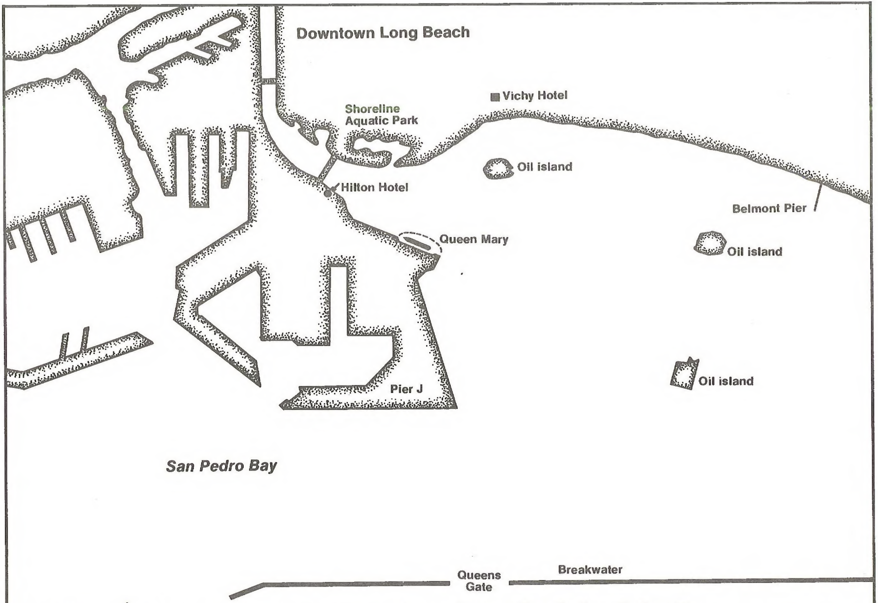


Figure 2.1.10.1-2 Visual resources Port of Long Beach-San Pedro Bay

Within the Port of Long Beach the old luxury liner, the Queen Mary, has been given a permanent berth in a location within the foreground visibility zone of downtown Long Beach. The Queen Mary screens much of the industrial visual clutter of the Port from view of the Long Beach shoreline. The Queensway Hilton Hotel, located on Pier J is a striking architectural landscape complement to the Queen Mary and also serves as a visual screen. The Port of Long Beach is planning other facilities to enhance the visual character of the Port complex facing the city of Long Beach, including pleasure boat marinas between the Queensway Hilton and Queen Mary and, south of the Queen Mary, a theme amusement park and a cruise ship terminal. These facilities, when developed, will further industrial visual clutter of the Port complex from view of the city of Long Beach and San Pedro Bay. Pier J lies within the middleground visibility zone of much of the Long Beach shoreline. Pier J is within the foreground-middleground visibility zones for sail and power boaters on San Pedro Bay east of the Port complex, which is a heavily used recreational waterbody.

The California Coastal Plan (1975) defines policies and guidelines for coastal appearance and design. Applicable policies and guidelines include:

No. 44 Design Development to Protect Coastal Viewshed -- "new development shall be designed so that the viewshed quality . . . can be enhanced by addition of attractive improvements."

No. 51 Design Guidelines: Scales, Height and Materials -- "development . . . shall enhance the quality of areas that have been degraded by existing development."

No. 52 Design Guidelines: Landscaping -- "plant materials shall be used to screen or soften the visual impact of new development."

No. 55 Design Guidelines: Utility Structures -- pertains to undergrounding of distribution and transmission facilities.

No. 56 Design Guidelines: Major Public Services, Commercial and Industrial Facilities -- "major industrial facilities that do not require water or oceanfront locations shall not be located in the oceanfront area . . . . Facilities shall be designed in a manner that is compatible with the surrounding natural landforms and manmade environment (e.g., by use of harmonizing colors, textures and massing or by undergrounding) . . . ."

2.1.10.2 Greater Los Angeles urban landscape

Description of the visual resources in the greater Los Angeles urban area will be limited to the visual corridor potentially impacted by the proposed pipeline project, including power-line transmission lines and storage tanks. The visual corridor of the proposed pipeline is that portion of the urban landscape from which the project may be visible. Within the relatively flat urban landscape, visibility of any potential disturbance of land surfaces or vegetation patterns or aboveground pipeline valves and bridging is essentially restricted by the buildings and other structures to the immediate area of the pipeline corridor. However, where the pipeline traverses relatively steep undeveloped landforms it may be exposed to a large portion of the urban landscape; however, visibility within the urban area is then limited by the reduced air quality of the Los Angeles Basin. Portions of the project with potentially high visibility include the storage tanks and power-line extensions.

Los Angeles County

The proposed pipeline route from Pier J in Long Beach Harbor through Los Angeles County follows flood control channels of the Los Angeles River, Rio Hondo, and San Jose Creek. These sterile, concrete-lined, channelized watercourses are largely lacking in scenic and natural values and are regarded as visual eyesores, especially when further encumbered with overhead transmission lines. Nevertheless, due to the built-up urban nature

of the surrounding landscape, these channels have a linear open-space value which could be greatly enhanced by landscaping. The pipeline corridor also skirts the Whittier Narrows Flood Control Basin, a major open-space area, and a number of park and recreation areas with considerable open-space value (see Section 2.1.12.2). The proposed Dominguez Hills terminal is located in an industrial area with existing tank farms within 1 mile of the terminal site.

2.1.10.3 Pipeline route -- rural and natural landscapes

The following description of visual resources (scenery, natural beauty, aesthetics) is restricted to the visual corridor of the applicant's proposed project. The visual corridor is defined as that portion of the landscape from which a potential observer on the ground, with normal visual acuity unaided by magnification, might discern a portion of the applicant's proposed project.

The visual corridor has been limited laterally to 15 miles on each side of the applicant's proposed project; beyond this distance, potential observation would fall in the distant background visibility zone where discernment of landscape detail and man-made changes to the landscape, on the scale of the applicant's proposed project, is not likely.

Within this 30-mile-wide visual corridor, portions of the landscape, which are screened by topography or vegetation from potential observation, have been delineated. Where the pipeline traverses gentle slopes (less than 5 percent slope), observation of the pipeline scar would be limited laterally from .25 to .5 mile, unless there are opportunities afforded by topographic features, such as hills, mountains, or escarpments, for an observer at higher elevation to look down upon the pipeline scar. Traversal of steeper slopes (over 5 percent slope) by the pipeline would expose the pipeline scar to potential observation from the surrounding landscape. Portions of the applicant's proposed project, involving aboveground facilities, such as pump

stations, or overhead utilities, such as power-line extensions, have greater exposure to observation from the surrounding landscape than the buried pipeline.

The Bureau of Land Management has recently adopted Manual Series 6300 on visual resource management, but there has not been sufficient time to incorporate consideration of visual resources into the BLM planning process for the National Resource Lands that are traversed by the proposed pipeline project. Therefore, for purposes of this statement, only areas likely to be judged as of relatively high scenic value (BLM Class A or B scenic quality) or visual sensitivity (BLM high or moderate visual sensitivity) where visual resource management restrictions would be more stringent would be identified (i.e., BLM Class II or III lands); for the remainder of the area less stringent visual resource management restrictions would be assumed (i.e., BLM Class IV lands).

Judgments of scenic quality involve consideration of the inherent variety, harmony, and contrast of forms, lines, colors, and textures of a segment of the landscape along the applicant's proposed corridor relative to its regional context, in terms of landforms, rock outcroppings, vegetative patterns, water features, man-made intrusions, and uniqueness. Segments of the landscape of relatively high scenic value within the regions traversed by the proposed pipeline system would be areas of considerable landform relief, colorful rock outcroppings, mosaics of diverse plant communities or specimen plants, few man-made intrusions, or perennial water features. Much of the existing and proposed pipeline corridor traverses extensive, flat, featureless areas with uniform monotonous desert brushland or grassland vegetation. While these areas do have relatively low scenic value (i.e., BLM Class C scenic quality), they nevertheless may have open-space value if relatively free of inharmonious modern visual intrusions, such as structures and power lines.

Judgments of visual sensitivity involve consideration of people's uses of and concerns for maintenance of scenic quality and open space. Within the visual corridor of the proposed project, examples of visual sensitivity would be areas visible from: scenic highways or tourist routes, wilderness or primitive areas, designated and developed parks and recreation areas, resort, retirement or second-home communities, recreational water bodies, and areas experiencing considerable backcountry, recreational vehicle, or undesignated camping use. Much of the existing and proposed pipeline corridor traverses areas of relatively low visual sensitivity (i.e., BLM seldom seen zones).

California

Visual resource areas of concern for rural and natural landscapes are illustrated in Figure 2.1.10.3-1. More detailed information appears in Maps 2.1.10-1 through 2.1.10-5 (Attachment 1).

Puente Hills. The Puente Hills south of Pomona and east of the Diamond Bar community development, is a steeply rolling grasslands area, relatively free of intrusions. Because of proximity to the greater Los Angeles urbanized landscape, the area has high scenic and open-space values. However, the major portions of the proposed pipeline corridor are not visible from residential areas, public roads, or public park or recreation areas. The Corona Freeway (California 71) is the one area of visual sensitivity within the visual corridor.

Chino to Redlands. The pipeline corridor traverses agricultural irrigated croplands and orchards of San Bernardino County. However, the agricultural areas have numerous urban visual intrusions including power lines, residential subdivisions, industrial and commercial areas, and an extensive road grid; thus, this is not a rural area of high scenic quality. Nevertheless, the area traversed by the pipeline corridor has high open-space value because of the proximity of the greater Los Angeles

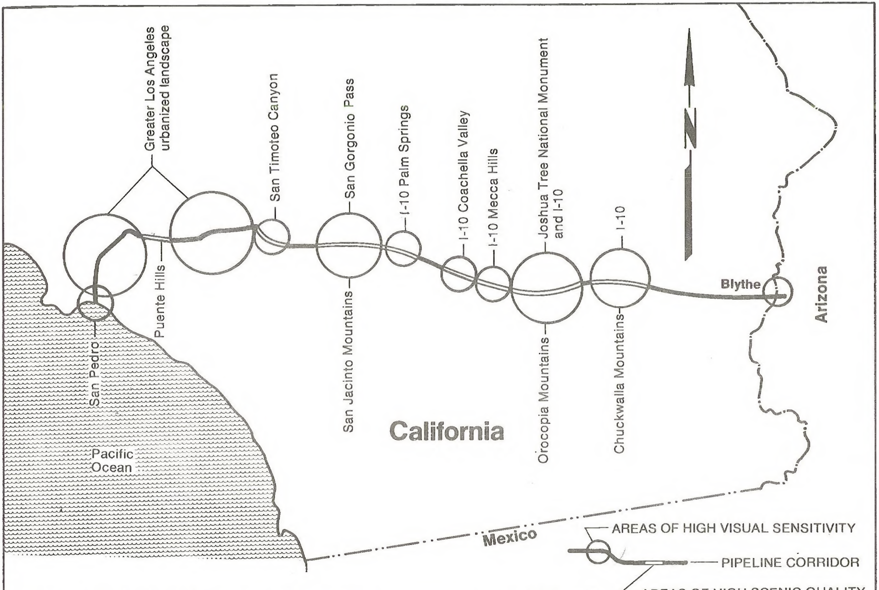


Figure 2.1.10.3-1 Areas of aesthetic concern — California

urbanized landscape. The Santa Ana River does retain some scenic and natural values. Areas of visual sensitivity would include numerous landscaped streets and freeways, vinyards, orchards, and the Santa Ana River area.

Redlands to Beaumont. The proposed pipeline corridor largely follows the Southern Pacific railroad through the San Timoteo Canyon. California grasslands and riparian oak-laurel are found on the narrow valley floor; coastal sage and chaparral occur on hillsides. Agricultural and recreational areas, including small lakes, are found in the canyon bottomlands. Power lines intrude on the western hillsides. Overall scenic quality is nevertheless high. Considering the proximity of this rural landscape to the greater Los Angeles urbanized landscape, this corridor traverses an area of visual sensitivity especially as viewed from the county road.

Beaumont to Indio. The existing pipeline corridor, with a linkup in the vicinity of Beaumont, traverses the San Gorgonio Pass to the broad Coachella Valley, skirting the Indio Hills. Through the San Gorgonio Pass, vegetation changes from a coastal-chaparral to desert creosote bush brushlands in the Coachella Valley. The route encompasses the areas in the San Gorgonio Pass and Coachella Valley and the urbanized areas of Beaumont and Banning. Retirement/second home subdivisions and trailer parks exist in the Palm Springs-Indio area. There are a number of man-made intrusions including overhead utility lines, pipeline scars and highway drainage channelization berms in the San Gorgonio Pass-Coachella Valley corridor traversed by the pipeline. Nevertheless, the area traversed by the pipeline has scenic value, considering the overall environmental setting of San Gorgonio Pass-Coachella Valley which is surrounded by high mountains. Areas of high visual sensitivity within the visual corridor of the existing pipeline include:

1. Interstate 10, a tourist route and scenic highway.

2. Urbanized areas of San Gorgonio Pass-Coachella Valley, including Beaumont, Banning, Palm Springs, Thousand Palms, Indio.

3. San Bernardino National Forest with San Bernardino Mountains north of the pass and San Jacinto Mountains south of the pass, overlooking the corridor.

4. Joshua Tree National Monument. Little San Bernardino Mountains overlooking the corridor.

Indio to Desert Center. The existing pipeline crosses the colorful Mecca Hills and traverses -- with Interstate 10 -- Shavers Valley and the Hayfield Lake area of Chuckwalla Valley, both narrow desert valleys between the desert mountain ranges. Vegetation on the south is largely creosote bush brushlands with small wash areas of desert shrubs, such as the picturesque ocotillo. The pipeline scar, overhead power lines, and highway drainage channelization berms are significant visual intrusions. Overall scenic quality is, nevertheless, moderately high. Areas of visual sensitivity within the visual corridor include:

1. Interstate 10, a tourist and scenic highway.

2. Joshua Tree National Monument, a portion of which overlooks the corridor.

3. Orocopia and Chuckwalla mountains which experience considerable recreational vehicle use.

Desert Center to Colorado River (Blythe). The corridor traverses the broad desert expanse of Chuckwalla Valley, with rather uniform monotonous vegetative cover of creosote bush-bur sage, except for some desert wash

shrublands including ocotillo, in the Hell-Ford Dry Lake area. The corridor also traverses irrigated croplands in the Blythe-Palo Verde Valley. Except for the Chuckwalla Mountain bajada between Desert Center and Hell, overall scenic quality of the pipeline corridor through the Chuckwalla Valley is relatively low as a result of the rather monotonous, featureless landscape. The Palo Verde Valley has relatively high scenic quality, because of its lush contrast with the surrounding desert, despite urban development in the Blythe area. The Colorado River is also relatively high in scenic quality as an impressive one-quarter-mile ribbon of water through an arid landscape.

Areas of high visual sensitivity include:

1. Interstate 10, because of its heavy tourist traffic.

2. The Colorado River, because of its heavy recreational use and retirement and second home developments along the west bank.

Arizona

Visual resource areas of concern are illustrated in Figure 2.1.10.3-2. More detailed information appears in Maps 2.1.10-6 through 2.1.10-9, Attachment 1.

Colorado River to Kofa Game Range. From the Colorado River, the pipeline corridor traverses a bajada with extensive desert pavement dissected by washes, then crosses the rugged, colorful Dome Rock Mountains in two washes over a low pass. The pipeline then traverses the La Posa Plain, visually enclosed by desert mountain ranges and covered by desert pavement, to the Kofa Game Range. Vegetation consists of desert brushlands interspersed with picturesque saguaro, ocotillo, and palo verde. The existing pipeline scar, a power line parallel to U.S. Route 95, and communications equipment on Cunningham Peak are significant visual intrusions on open-space values. Overall scenic quality is nevertheless moderately high.

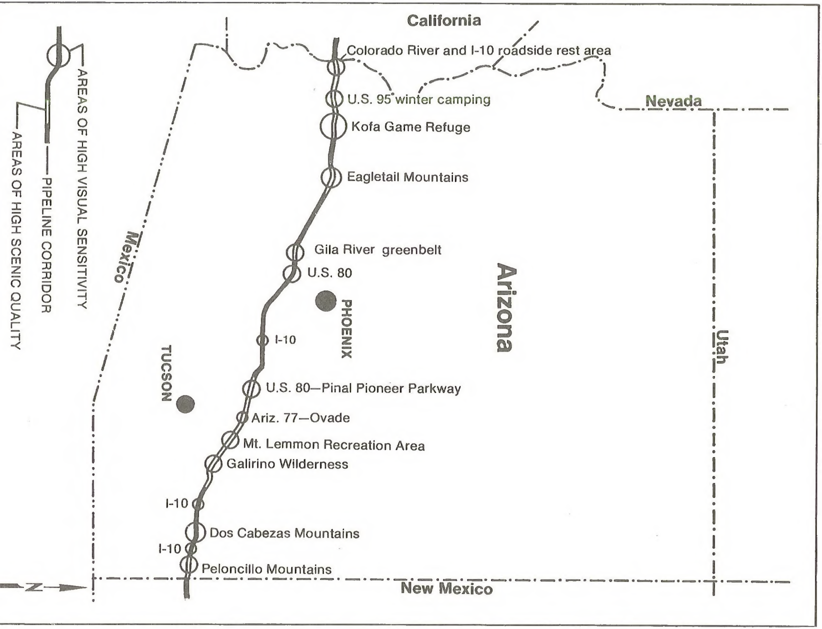


Figure 2.1.10.3-2 Areas of aesthetic concern - Arizona

Areas of visual sensitivity within the visual corridor include:

1. Interstate 10, a heavily trafficked tourist route with a roadside rest area with interpretive signing.

2. The Colorado River, with heavy recreational use.

3. U.S. Route 95, a heavily trafficked tourist route.

4. The La Posa Plain, which experiences extended-stay camping in winter by "snowbirds" (tourists).

Kofa Game Range to Gila River. The pipeline traverses a narrow desert valley in the Kofa Game Range between the Kofa and Plumosa mountains and then crosses broad plains to the Gila River, except for the bajada of the spectacular Eagletail Mountains. The vegetation on the Kofa Game Range and on the Eagletail Mountains bajada is the desert brushlands with saguaro, ocotillo, and palo verde. The vegetation across the broad desert plains is predominantly creosote bush except for some irrigated agricultural lands in the Centennial Wash and Arlington Valley areas. The existing pipeline scar is a significant visual intrusion on open-space values. Scenic quality through the Kofa Game Range and Eagletail Mountains bajada is nevertheless moderately high, with the remainder of the route relatively low.

Areas of visual sensitivity within the visual corridor include:

1. The Kofa Game Range (because of proposed wilderness area and recreational use along the existing pipeline scar).

2. The Eagletail Mountains (because of potential primitive area designation).

3. Saddle Mountain, a scenic area with backcountry recreational use, 3 to 5 miles north of the pipeline.

<u>Gila River to vicinity of Coolidge</u>. The existing corridor is routed across a series of broad plains. The western portion is largely desert creosote bush, while the eastern portion is largely agricultural. The Gila River greenbelt is a thicket of salt cedar-mesquite. There are many small towns in the agricultural area between Stanfield and Coolidge. The pipeline corridor crosses the Gila River greenbelt, an area of moderately high scenic quality; the remainder of the route is relatively low in scenic quality and open-space value because of numerous intrusions. Within the visual corridor of the existing pipeline corridor, areas of visual sensitivity include (1) U.S. Route 80, a tourist route; (2) Interstate 10, a tourist route; (3) the Gila River greenbelt, a heavy recreational-use area; (4) the Arlington Wildlife Refuge, a heavy recreational-use area; and (5) Buckeye Hills County Park.

<u>Vicinity of Coolidge to vicinity of Oracle</u>. The pipeline corridor traverses a series of bajadas with desert pavement. Vegetation consists of desert brushlands with picturesque saguaro, ocotillo, palo verde, and cholla at lower elevations northwest of Black Mountain, giving way to desert grasslands with yucca at higher elevation southeast of Black Mountain. The existing pipeline scar and power lines approximately parallel to U.S. Route 80 and Arizona 77 are significant intrusions on open-space values. Overall scenic quality is moderately high as a result of a striking variety of picturesque desert vegetation.

Areas of visual sensitivity within the visual corridor include (1) U.S. Routes 80-89 (Pinal-Pioneer Parkway); (2) Arizona 77, another scenic highway; (3) the Black Mountain area, a popular hunting area; and (4) Oracle, with a significant number of second homes and retirement residences.

Vicinity of Oracle to vicinity of Willcox. The existing pipeline corridor is routed down and across San Pedro Valley from Oracle and thence across foothills of the Winchester Mountains to Sulphur Springs Valley. Vegetation changes from yucca-grasslands near Oracle to desert saguaro-palo verde brushlands in San Pedro River valley to yucca-grasslands and then oak brush-chaparral in the foothills of the Winchester Mountains. A mesquite bosque (thicket) is found along the San Pedro River. The existing pipeline scar and a power line down San Pedro Valley are significant visual intrusions on open-space values. Overall scenic quality of the immediate area traversed by the existing pipeline is nevertheless moderately high.

Within the visual corridor of the existing pipeline, areas of visual sensitivity include (1) the Galiuro Wilderness of the Coronado National Forest, and (2) Mt. Lemon recreation area in the Santa Catalina Mountains of the Coronado National Forest.

Vicinity of Willcox to New Mexico state line. The existing pipeline corridor from the Winchester Mountains is routed across the Sulphur Springs and San Simon valleys and the base of the Dos Cabezas Mountains and then across foothills of the Peloncillo Mountains at the state line. Vegetation is largely desert yucca-mesquite grasslands with some agricultural use. The San Simon Valley was once renowned for lush grasslands which are being restored after massive gullying. The existing pipeline corridor is routed close to the small towns of Bowie and San Simon in the San Simon Valley.

The foothills of the Peloncillo Mountains and the base of the Dos Cabezas Mountains are areas of significant scenic value; the remainder of the route is relatively low in scenic quality and open-space values as a result of numerous intrusions. Within the visual corridor of the existing pipeline areas of visual sensitivity include (1) the Dos Cabezas Mountains with scenic, primitive, historic, and recreational values, and (2) the Peloncillo Mountains with scenic, historic, and recreational values.

New Mexico

Figure 2.1.10.3-3 shows visual resource areas of concern and Maps 2.1.10-9, through 2.1.10-12 (Attachment 1) present more detailed information.

State-line vicinity of Lordsburg to state-line vicinity of El Paso. The existing pipeline corridor is largely routed across broad flat plains. However, the pipeline crosses foothills of the Peloncillo Mountains near the Arizona state line and Anthony Gap, a low pass in the Franklin Mountains near the Texas state line. Vegetation is typically desert cresote bush brushlands, mesquite grasslands, or mesquite dunes. The mesquite grassland area between Lordsburg and Deming has picturesque yucca and agave plants. The pipeline crosses an alkali flat near the Arizona state line. Agricultural uses occur in the Lordsburg and Deming areas and the floodplain of the Rio Grande.

Foothills of the Peloncillo Mountains and Anthony Gap are the only areas of significant scenic value traversed by the pipeline. However, the existing pipeline corridor does cross extensive areas with open-space values and the existing pipeline scar is a significant visual intrusion.

Within the visual corridor of the existing pipeline corridor, the only area of visual sensitivity would be Interstate 10, which carries heavy tourist traffic.

State-line vicinity of Pecos River to state-line vicinity of Jal. The existing pipeline corridor is routed across a broad flat plain. Vegetation is largely desert cresote bush and mesquite lands except for salt cedar thickets near the Pecos River and short-grass prairie in the vicinity of Jal. Agricultural lands are crossed west of the Pecos River.

The existing pipeline corridor does not cross any areas of significant scenic value except for the Pecos River. However, the area traversed by the

Figure 2.1.10.3-3 Areas of aesthetic concern - New Mexico

existing pipeline corridor has open-space value and the existing pipeline scar is a significant visual intrusion.

There are no areas within the visual corridor of visual sensitivity.

Texas

Visual resource areas of concern are illustrated in Figure 2.1.10.3-4 and more detailed information is found in Maps 2.1.10-10 through 2.1.10-12 (Attachment 1).

State-line vicinity of El Paso to state-line vicinity of Pecos River. The existing pipeline corridor is largely routed across flat-to-rolling plains, except for the low, rolling Hueco Mountains and the Delaware Mountains. Vegetation is typically desert cresote bush, with some mesquite dunes, except for the Delaware Mountains where juniper-oak brush is encountered.

The existing pipeline corridor does traverse two areas of moderately high scenic value. The salt flats southwest of Guadalupe Mountains National Park are a visual mosaic of intermittent, usually dry, lake beds exhibiting vivid colors interspersed in desert brush. The Delaware Mountains, south of Guadalupe Mountains National Park, have an imposing west-facing escarpment and a gentle east-facing slope dissected by small canyons with juniper, oak brush, yucca, and agave. Much of the remaining lands traversed by the existing pipeline corridor have open-space values, and in these areas the existing pipeline scar is a significant visual intrusion.

Within the visual corridor of the existing pipeline corridor, there are a few areas of visual sensitivity, namely:

1. Franklin Mountain State Wilderness Park, which encompasses a high, rugged desert mountain range. The park overlooks the

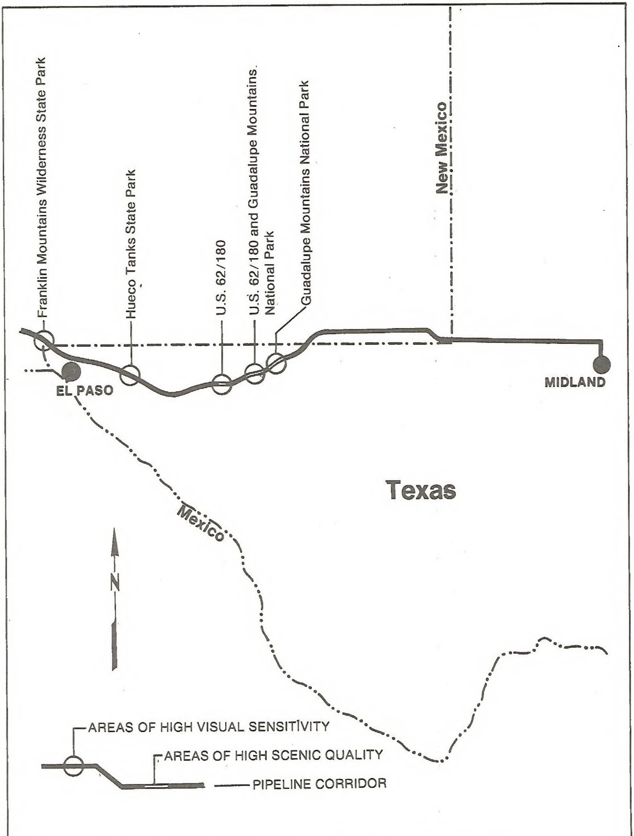


Figure 2.1.10.3-4 Areas of aesthetic concern - Texas

existing pipeline scar in the middleground and background visibility zones from many superior elevation points.

2. Hueco Tanks State Park, a dense cluster of monolithic red sandstone outcroppings, and an oasis of tanks (ponds) and cottonwood. The existing pipeline corridor skirts around the park on the west and south within the foreground visibility zone.

3. U.S. Routes 62-180, a scenic highway in the vicinity of Guadalupe Mountains National Park. There are outstanding views from this highway across the salt flats of the Guadalupe Mountains. The highway overlooks, within the foreground visibility zone, the pipeline scars crossing the west-facing escarpment of the Delaware Mountains.

4. Guadalupe National Park. Higher elevations within the park overlook the existing pipeline scar through the Delaware Mountains in the background visibility zone.

New Mexico state line to Midland. The proposed pipeline corridor crosses a broad flat plain, with extensive sand dunes near New Mexico, and numerous sink holes near Midland. Vegetative cover is largely short-grass prairie interspersed with clumps of mesquite and shin oak. The proposed pipeline corridor crosses oil fields west of Midland and agricultural areas in the Midland vicinity.

There are no areas significant of scenic value in the path of the proposed pipeline corridor. However, the proposed pipeline corridor does cross an extensive area of open-space values presently unencumbered by man-made intrusions between the state line and Texas 115 (approximately 12 miles).

There are no areas of visual sensitivity within the visual corridor of the proposed pipeline.

Midland. The proposed terminal is located in an existing industrial tank farm east of Midland near agricultural lands. Scenic values are relatively low, but the site is a part of the foreground visibility zone of Interstate 10 and U.S. Route 80.

2.1.11 Noise

General characteristics of community noise

The noise environment of a typical urban or suburban community has a base of steady "background" noise, which is the sum of many distant and indistinguishable noise sources. Superimposed on the background noise is the noise of individual local sources. These can vary from an occasional aircraft flying over to virtually continuous noise from traffic on a major freeway.

To describe noise environments and to assess impact on noise sensitive areas, a frequency weighing measure which simulates human perceptions is customarily selected. A-weighted ratings of noise sources, which reflect the human ear's reduced sensitivity to low frequencies, have been found to correlate well with human perceptions of the annoying aspects of noise. Consequently, A-weighted noise levels, described in decibels-A (dBA), are the values cited in most noise criteria. Decibels are logarithmic units that conveniently compare the wide range of sound intensities to which the human ear is sensitive.

Noise impacts are expected to be well represented by median (average) noise levels during the day (construction) or night (operation of pump stations); these are decibel levels exceeded 50 percent of the time. Median noise levels are also typical of the existing environment (Forman, 1974). Noise levels are generally considered low when below 45 dBA, moderate in the 45 to 60 dBA range, and high above 60 dBA (Table 2.1.11-1). Various environments can be characterized by levels that are acceptable or unacceptable. Lower

Table 2.1.11-1

Qualitative Descriptors of Various Land Use Categories

and Approximate Daytime Median Noise Level (L_{50}):

Comparison of Three Independent References

LOCATION	L_{50} dBA	LOCATION	Midpoint of Range dBA	LOCATION	L_{50} dBA
Grand Canyon	20				
Farm in valley	39				
Quiet suburban residential	43	Quiet residential	45	Residential-single family	53
Normal suburban residential	48	Average residential	55	Residential-institutional	57
Urban residential	55	Semicommercial	55	Residential-multiple units	57
Noisy urban residential	58	Commercial	60	Residential-industrial	58
Very noisy urban residential	63	Industrial	65	Residential-commercial θ	63
		Sidewalk of commercial	75		
Source: EPA, 1971.		Source: Beranek, 1971.		Source: Forman, 1974.	

levels are more unacceptable in suburban areas, for example, than in commercial or industrial zones. Nighttime ambient levels in urban environments on workdays are about 7 decibels lower than the corresponding average daytime level.

Methodology for determining existing noise environment

To adequately characterize the community noise environment (for the purpose of subsequently assessing noise impacts), it is necessary to identify the following elements: noise sensitive receptors, noise sources, special terrain features, and noise levels.

Aerial mosaics in Appendices 2A.11-A and 2A.11-B of the Williams Brothers Environmental Impact Assessment (WBEIA) Volume 6 and the California, Arizona, New Mexico, and Texas series mosaics of Volume 7, were employed to locate the project corridor and to provide information on land uses in the general proximity of the corridor. Corrections to the WBEIA presentation in defining the pipeline route were also noted.

A thorough review of the aerial mosaics was performed in order to identify noise sensitive receptors potentially affected by the project. Noise sensitive receptors are considered to be areas or land uses in which people could be adversely affected by environmental noise. (Noise impacts on wildlife are discussed in that context in Chapter 3.) Noise sensitive receptors typically found near the California portion of the project corridor are residences and schools. Other examples of sensitive receptors are churches, synagogues, hospitals, and parks. Conservative bounds on the width of the corridor potentially impacted by noise were estimated to be approximately 1,500 feet for the urban areas, and 6,000 feet for the rural areas.

Noise sources such as freeways, railroads, and industrial plants were also identified. The highest level noise source is the strongest determiner of the ambient noise level. Two sources that need consideration are freeway

traffic (about 80 dBA at 100 feet) and average traffic (about 70 dBA at 100 feet). Appendix A3.1.11 discusses how to add noise levels from more than one source.

Noise levels were determined by using accepted relationships between land use patterns (and major local noise sources) and resulting community noise levels. The aerial mosaics were reviewed and compared with generalized land use-noise level data. Measured data were available for some communities along the proposed pipeline route and were used to verify and augment the land use-noise level approach.

Assuming an adequate physical description of the area near a sensitive receptor, experience has indicated that it is possible to estimate the average workday level to within 5 dBA. A comparison of the results from three independent references for daytime median levels is presented in Table 2.1.11-1. This table shows both the possible range in median values for different land uses as well as the generally consistent agreement between independent studies. Figure 2.1.11-1, based upon an Environmental Protection Agency (1971) report, is a bar graph portrayal of 18 noise case studies of prototypical noise environments.

2.1.11.1 Long Beach Port and terminal

Sources and levels

Ambient noise levels in the area are highest in the port and along major transportation arteries. No major noise studies, however, have been conducted in the port. Some information of a general nature is embodied in the general plan for Long Beach, and noise measurements are available in various assessment documents for projects in the Long Beach and Los Angeles ports.

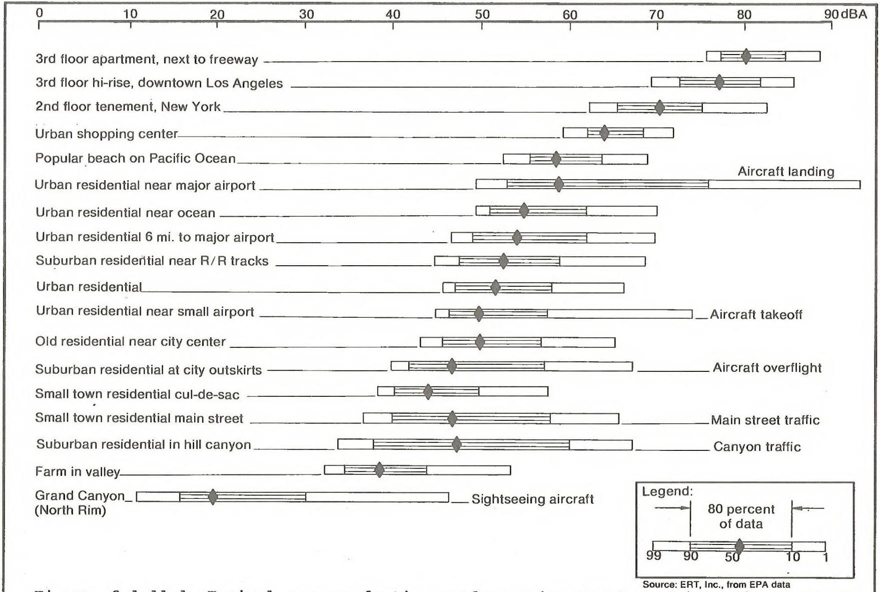


Figure 2.1.11-1 Typical average daytime outdoor noise levels and intruding sources

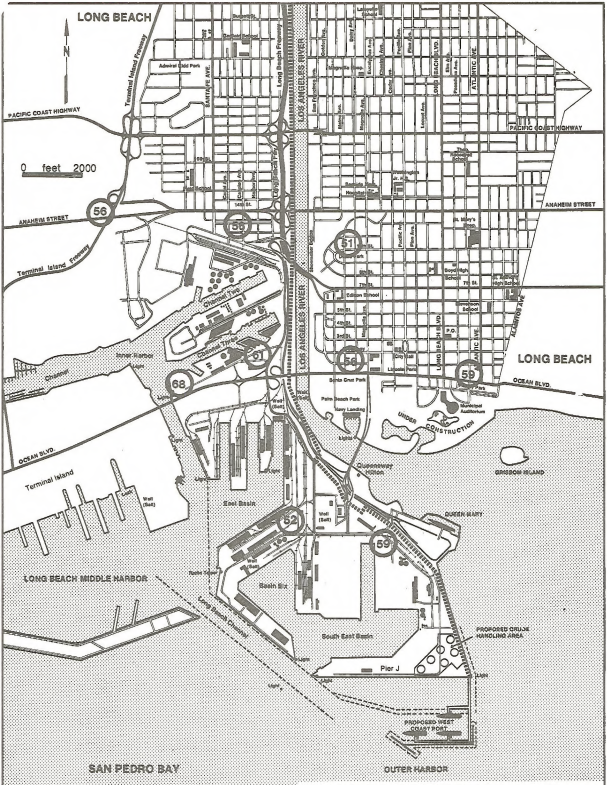
Figure 2.1.11.1-1 plots estimated median noise level statistics, based on measurements made near Pier J and compiled by Socio-Economic Systems, Inc. (Port of Long Beach, 1976).

The highest estimated median value is 68 dBA near the Gerald Desmond Bridge which crosses the channel between the inner harbor and east basin and is approximately 3 miles northwest from the proposed Pier J facility. The noise level is of residential magnitude (52 dBA) near the Exxon oil tank farm approximately 1.5 miles northwest of the facility. The noise level is at an intermediate residential-industrial level (59 dBA) in the Pier J container area between the Queen Mary and the proposed pier construction. Commercial and residential areas adjacent to the port have levels typical for these land usages.

Measurements were made in the residential area to the east of the Dominguez Hills terminal site subsequent to the compilation of Table 2.1.11.2-1 discussed immediately below. These measurements along Harding Street confirmed the results of the methodology described above and were used in developing the table. The readings in the residential area were 50 to 55 dBA. The Dominguez Hills terminal site was found to be at a low commercial ambient noise level, punctuated by noise from bulldozers and dirt trailer trucks working in the northeast corner of the site, and by noise from trail bikes on the general flat area of the site.

2.1.11.2 Pipeline route

Table 2.1.11.2-1 presents the results of a detailed review of the existing noise environment along the potential noise impact corridor of the proposed pipeline project. Included in this table are identification of sensitive receptors, local noise sources, and the distance of sensitive receptors to existing noise sources and to the project locus. The estimated daytime median noise level is presented for each sensitive receptor area based upon the methodology described in Section 2.1.11. Table 3.1.11.2.1-1 in Chapter



Source: Port of Long Beach/PUC, Draft Environmental Statement

Figure 2.1.11.1-1 Daytime L_{50} estimates for ambient noise levels, Port of Long Beach

Table 2.1.11.2-1

Sensitive Receptors, Existing Noise Sources, and Existing Noise Levels

SENSITIVE RECEPTOR	Ref. Map[a]	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
Palm Beach Park	A-2	800	Freeway & interchange	1,200	60
			Freeway & interchange	1,700	
			Marine activities, Navy shipyard	900	
Edison School	A-3	1,200	Freeway & interchange	200	70
			Rail tracks	600	
Drake Park	A-3	1,200	Freeway	200-1,300	70
			Rail tracks	400	
Residences	A-3	1,200	Freeway	200-1,300	70
			Rail tracks	100-500	
Garfield School	A-4	1,600	Freeway	1,400	60
Residences	A-4	250	Freeway	100	75
Residences	A-4	700	Freeway	850	60
Muir School	A-5	1,200	Freeway	1,050	60
Birney School	A-5	1,500	Freeway	1,600	60
Residences	A-5	800	Freeway	900	60
Residences	A-5	300	Freeway	100	75
Los Cerritos School	A-6	1,500	Freeway	1,050	60
			Rail tracks	200	

[a] A and B series maps in Appendix 2A.11 in Vol. 6 of Williams Brothers Environmental Impact Assessment, March, 1976; T and no-letter maps refer to applicant submittal designated "Job 2276," dated 27 July 1976.

Table 2.1.11.2-1 (Continued)

SENSITIVE RECEPTOR	Ref. Map	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
Los Cerritos Park	A-6	1,800	Freeway	650	65
			Rail tracks	200	
Residences	A-6	900	Freeway	1,200	60
			Rail tracks	100	
Country Club	A-6	1,100	Freeway	1,800	55
Union School	A-7	1,700	Freeway (Long Beach)	1,250	60
Sutter School	A-7	300	Freeway (Long Beach)	1,250	60
Residences	A-7	200	Freeway (Long Beach)	1,150	60
Residences	A-8	200	Freeway	1,200	60
Coolidge Park	A-8	1,100	Freeway	100	80
Houghton Park	A-8 a,b	1,600	Local street traffic		55
Residences	A-9	150	Freeway interchange Rte 7 & 91	900	65
Jordan High School	A-9	1,300	Freeway interchange Rte 7 & 91	900	60
Dominquez High Sch.	A-10	800	Freeway (Long Beach)	1,250	60
Residences	A-10	250	Freeway (Long Beach)	800	60
Golf course	A-10	<100	Freeway (Long Beach)	600	60
Los Cerritos School	A-10	1,250	Freeway (& local street)	2,000	60
Residences	A-11	250	Freeway (Long Beach)	700	60
Hollydale School	A-11	950	Freeway (Long Beach)	1,400	60
Grove School	A-11	1,350	Freeway (Long Beach)	1,850	60
			Rail tracks	600	60
Will Rogers School	A-11	900	Freeway	350	60
Ham Mem. Park	A-11	1,700	Freeway	1,100	60
Golf course	A-12	1,500	Freeway	1,900	55
Residences	A-12	400	Freeway (Long Beach)	1,050	55
			Rail tracks	1,000	

Table 2.1.11.2-1 (Continued)

SENSITIVE RECEPTOR	Ref. Map	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
Los Padrinos Juvenile Hall	A-12	1,100	Freeway (Long Beach)	1,950	55
Residences	A-13	500	Local streets & industries		55
John A. Ford Park	A-14	<100	Local streets		55
Rio Hondo Country Club	A-14	<100	Local streets & commercial areas		55
Residences	A-14	200	Local streets & commercial areas		55
Suva Street School	A-14	1,600	Local streets & commercial areas		55
Residences	A-15	100	Urban residential neighborhood		50
Park	A-15	500	Industrial area	100	60
Sanitarium	A-15	1,600	Commercial-residential	200	55
Residences	A-16	450	Urban residential neighborhood		55
			Rail tracks	100	
			Industrial area	200	
St. Vincent's School (& Seminary)	A-17	600	Urban residential neighborhood		50
			Rail tracks	2,100	
			Industrial area	2,200	
Residences	A-17	550	Urban residential neighborhood		50
Residences	A-18	200	Local streets		55
Rio Hondo Park	A-18	200	Local streets		55
Park	A-18	200	Local streets		55

Table 2.1.11.2-1 (Continued)

SENSITIVE RECEPTOR	Ref. Map	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
Montebello Gardens School	A-18	1,700	Local streets		55
Grant Rec. Mem. Park	A-19	100	Suburban-residential		50
Residences	A-19	300	Suburban-residential		50
Pio Pico School	A-19	1,400	Suburban-residential		50
Residences	A-20	<100	Suburban-residential		45
			Rte. 605 (San Gabriel River Freeway)	2,600	
Wildlife sanctuary and park	A-21	2,600	Freeway	2,800	50
Equestrian area	A-21	500	Freeway	700	60
California Country Club	A-22	300	Rte 605	<100	75
Residences	A-22	200	Rte 60	1,000	65
North Whittier School	A-23	1,500	Freeways	2,000	60
Residences	A-23	300	Rail tracks	550	60
	A-23		Rte 60	1,400	
Residences	A-24	400	Rail tracks	200	60
			Rte 60	500	
Latin American Bible Institute	A-24	700	Rail tracks	1,400	60
			Rte 60	2,600	
Valley Vocational Ctr.	A-25	600	Industrial activity	100	65
Residential	A-25	1,000	Industrial activity	400	65

Table 2.1.11.2-1 (Continued)

SENSITIVE RECEPTOR	Ref. Map	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
El Encanto Sanitarium	A-26	1,800	Industrial activity	200	60-69
Glenelder School	A-26	1,600	Industrial activity	400	60-69
Residences	A-26	300	Industrial activity & rail tracks	200	60-69
Hurley School	A-27	1,500	Commercial	800	60
Residences	A-27	500	Rail yard	200	70
Residences	A-28	1,000	Rail tracks, industry	200-400	65
Rorimer School	A-29	1,600	Rail tracks, industry	200-400	65
Residences	A-29	1,600	Rail tracks, industry	200-400	65
Residences	A-30	600	Rail tracks, industry	200-400	60
School	A-30	2,000	Rail tracks, industry	200-400	60
Walnut School	A-31	700	Rail tracks	800	55
Park	A-31	1,500	Rail tracks	1,600	55
Residences	7	3,000	Freeway	300	60
Residences	9	2,000			45
Boys Republic	10	600	Freeway	500	60
California Institute for Men	10	2,500	Rural		45
Hawthorn Christian School	12	400	Highway	200	55
Residences	12	100-200	Highway	3,000	45
Fontana Bird Park	B-5	2,000	Rural; quarries		45
Zimmerman School	B-5	2,500	Residential		50
Crestmore School	B-5	1,400	Residential		50
Park	B-5	100	Residential		50

Table 2.1.11.2-1 (Continued)

SENSITIVE RECEPTOR	Ref. Map	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
Residences	B-5	100	Residential		50
Union Academy	B-7	500	Residential		50
Hospital	B-7	500	Residential		50
Hospital	B-7	2,200	Residential		50
Loma Linda University	B-7	400	Residential		50
Community Hospital	B-7	1,600	Residential		50
Mission School	B-7	3,700	Rural		45
Bryn Mawr	B-7	100	Rural		45
Residences	B-7	100	Residential		50
Community Hospital	B-7	2,100	Residential, rail tracks	2,100	50
Creative Educational Center	B-7	200	Rural, San Timoteo Canyon Road	200	55
Ehrenberg Roadside Rest Area	B-32	1,500	Interstate 10	100	40-60
Hemmerling School	B-10	1,000	Residential		50
High School	B-10	500	Residential		50
St. Boniface	B-10	1,500	Residential		50
Residences	B-10	<100	Residential		50
Repplier Park	B-10	<100	Residential		50
Residences, school (Desert Center, CA)	B-23	1,200			40
Residences (Blythe, CA)	44	1,100			40
Ehrenberg Roadside Rest	B-32	1,500	Interstate	100	40-60
20 to 30 residences (Jal, NM)	T-1	200-700			40

Table 2.1.11.2-1 (Continued)

SENSITIVE RECEPTOR	Ref. Map	Approximate Distance, Sensitive Receptor to Project (ft)	Existing Significant Noise Sources	Approximate Distance, Sensitive Receptor to Sources (ft)	Approximate Daytime Median Noise Level at Sensitive Receptor (dBA)
Country Club	T-13	1,000			50
Residences (Midland, TX)		250			50

3 contains a reduced list of sensitive receptors that are most likely to experience noise impacts; the degree of impact is identified.

2.1.11.3 Midland terminal area

Sources and levels

The proposed oil receiving terminal at Midland is located approximately 3,000 feet from the closest sensitive receptors (residences). Examination of the aerial mosaics and planning maps indicate that the terminal is proposed for an area currently used as a tank farm with the adjacent land devoted to livestock grazing. Median noise levels in this area would be expected to be 40 dBA or lower (assuming no adjacent oil pumping or gas compressor operations). Noise levels within Midland would be expected to range from 40 dBA at the border to 55 dBA toward the municipal center.

2.1.11.4 Noise standards

Federal standards

There are no Federal noise standards directly regulating noise emissions from the proposed project either during construction or in the project's completed operational phase. There are, however, Federal noise standards and guidelines which could have an indirect bearing on community noise resulting from the construction phase for a project.

The occupational noise exposure of construction workers is limited by standards of the U.S. Secretary of Labor, pursuant to authority of the Williams-Steiger Occupational Safety and Health Act of 1970. These standards stipulate that workers shall be protected against the effects of excessive noise exposure, and that such protection may be accomplished via administrative and engineering controls. If such controls are not

effective, personal protective equipment is required in order to comply with this standard.

The U.S. Environmental Protection Agency has taken a number of steps directed toward the reduction of community noise levels (Federal Register, 28 May 1975; Lang, 1975). Of significance to the proposed project are recently issued directives pertaining to the regulation of the noise emitted by various types of newly manufactured construction equipment. To date, regulations have been established for portable air compressors, for medium and heavy-duty trucks and for jack hammers and rock drills. Wheel and track loaders and wheel and track dozers are under study for possible regulation.

State standards

California, Arizona, New Mexico, and Texas do not have noise laws, standards, or guidelines which apply to the construction or operation of the proposed pipeline facility. However, one state, California, has a requirement that each local government jurisdiction must perform noise studies, identify noise producing activities within the community, and adopt a noise element in their general plan.

County and municipal standards

Table 2.1.11.4-1 presents a list of noise elements for communities along the proposed pipeline route in California. These data are subject to additions in 1977. Where construction noise is regulated, it is typical to do so by limiting construction to a 0700 to 1900 time period. In some communities a six-day week (Monday through Saturday) is specified as well.

No local noise ordinances were found for municipalities outside of California through which the pipeline would pass.

Table 2.1.11.4-1

Local Government Noise Standards[a]

COUNTY	Place	Noise Ordinance Adopted	Ordinance Type	Regulation of Construction Noise	Noise Element Adopted	Local Noise Measurements
Los Angeles	County					
	Bell Gardens	Yes	-	No	Yes	-
	Commerce	Yes	Quantitative	No	Yes	No
	Compton	Yes	Nuisance	Yes (Hours)	Yes	Yes
	Downey	Pending	-	-	Yes	No
	Industry	No	-	No	Yes	-
	Long Beach	Yes	Nuisance	Yes	-	-
	Lynwood	Yes	Quantative	Yes (Hours)	Yes	Yes
	Montebello	Yes	Nuisance	Yes (Hours)	Yes	No
	Paramount	Yes	Yes	Yes (Hours)	Yes	No
	Pico Rivera	Yes	Nuisance	No	-	-
	Pomona	Pending	Nuisance	-	Yes	No
	South Gate	Yes	Quantitative	Yes	Yes	Yes
	Whittier	Yes	Nuisance	Yes	Yes	No
Riverside	County	-	-	-	Yes	No
	Banning	No	-	-	Pending	No
	Beaumont	No	-	-	Yes	No
	Blythe	Pending	-	-	Pending	No
	Indio	Pending	-	-	Pending	-

[a] Information subject to change.

Table 2.1.11.4-1 (Continued)

COUNTY	Place	Noise Ordinance Adopted	Ordinance Type	Regulation of Construction Noise	Noise Element Adopted	Local Noise Measurements
	Mira Loma[b]					
San Bernardino	County	No	-	-	Yes	No
	Chino	No	-	-	Yes	No
	Colton	No	-	-	Yes	No
	Crestmore[b]					
	Fontana	Yes	Quantitative	Yes	Yes	Yes
	Grand Terrace[b]					
	Loma Linda	Yes	Nuisance	No	Yes	No
	Redlands	No	-	Yes	Yes	No
	San Bernardino	No	-	-	Yes	No

[b] Unincorporated; see county data.

2.1.12 Land uses

The following sections offer a description of the existing environment in terms of land uses, exclusive of transportation and utilities, which are discussed under Sections 2.1.14 and 2.1.15, respectively.

2.1.12.1 Native American areas

Portions of two Indian reservations would be traversed by the proposed project. These are the Morongo and Aqua Caliente reservations in the vicinity of Banning, Palm Springs, and Thousand Palms, California. The Cabezon Reservation, near Indio, is south of the proposed alignment.

These areas are largely undeveloped and in a natural state. If available on the public market they would command values comparable to those of private or public lands for residential use or speculative purchase because of their winter climate and recreational features. The areas are administered by the Department of Interior's Bureau of Indian Affairs with concurrence and consultation of tribal councils.

Land use is nonintensive as the areas are primarily limited to grazing and outdoor recreation. Interstate 10 rights-of-way and various utility lines cross the Morongo Indian Reservation just east of the Banning Airport and extend to a point roughly 4 miles west of the White Water Post Office. The reservation lands are also traversed by the Southern Pacific Railroad.

The Aqua Caliente Reservation is likewise traversed by Interstate 10, the Southern Pacific Railroad, and utility lines from a point 3 miles west of Thousand Palms, California, for a distance of approximately 3 miles.

2.1.12.2 Scientific preserves and refuges

In addition to those areas of historic or archaeologic value, the proposal would involve other preserves or refuges in existence or under study for possible state or Federal legislative designation. These are addressed by state.

California

The California Coastal Commission, California Coastal Trails Plan, and State Departments of Parks and Recreation, Fish and Game, and the State Water Resources Control Board, in conjunction with Regional Water Quality Control Boards, have proposed areas both on and offshore along the coastline for estuarine preserves, areas of special biological significance, and/or marine parks.

Existing preserves include areas of the Channel Islands National Monument and the California Sea Otter Reserve which extends from San Simeon in San Luis Obispo County along the southern coast of Monterey to Carmel Bay. A complete listing of state and Federal coastal preserves and refuges can be obtained from the State Resources Agency or the U.S. Fish and Wildlife Service in Sacramento.

Inland preserves or refuges include Joshua Tree National Monument, a unit of the National Park Service. The southern boundary of this monument lies to the north and within 200 feet of the proposed alignment at its closest proximity. This natural area is primarily reserved for its vegetation and wildlife, and in particular, desert bighorn sheep. It broadly represents two different desert types locally referred to as the "high" and "low" desert areas. Historically, mining played a major land-use role in the monument, and several historical sites still remain. Details of land uses or plans can be obtained from the Superintendent at Joshua Tree National Monument, headquartered near Twenty-nine Palms.

Other Federal lands in California along the proposed alignment generally do not have specific refuge or reserve status but have been put to intensive recreational use or extractive uses via mining claim locations. Recreational uses have ranged from uncontrolled off-road vehicle operation to passive weekend photography or "rock hounding" until recent years when BLM inaugurated the California Desert Study leading toward the California Desert Management Plan. This study indicates that the BLM-administered area of the proposed alignment will remain open to off-road vehicles with conservation management controls.

State land, generally Sections 16 and 36 of every township, was given to California upon entering the Union for support of its schools and is generally subject to unrestricted recreational use. It has neither refuge nor reserve status. Various leases for surface and subsurface uses may exist, including rights-of-ways, grazing, or mineral materials. These lands are exclusively administered by the California State Lands Commission from Sacramento.

Arizona

Arizona's major Federal preserve is the Kofa Game Range, which lies east of the Colorado River in the Kofa Mountains. This area is under the administration of the U.S. Fish and Wildlife Service and is a particularly important habitat for the desert bighorn sheep. Uses have been limited to mining claims and mineral extraction. "Kofa" is an acronym for the King of Arizona Mine which is located in the mountains but is no longer operating.

The outer periphery of the game range and the adjacent public lands are used intensively for winter-oriented recreational use. Use of self-contained camping units has developed to the degree that in the late 1960s BLM developed campground facilities at Crystal Hills (refer to Section 2.1.12.3). At that time the Kofa Game Range was in the joint jurisdiction of BLM and the Bureau of Sport Fisheries and Wildlife (now U.S. Fish and

Wildlife Service). More recently the Kofa Game Range has become exclusively administered by the U.S. Fish and Wildlife Service.

No other Federal preserves or refuges are directly affected by the proposal; however, the proposed alignment and/or ancillary facilities do affect undeveloped areas of National Resource Lands in the Ehrenberg, Eagletail Mountains, and Livingston areas. Land uses here have been limited to seasonal grazing, mining claim location, utility corridors, and recreational activities. Development has been limited largely to primitive access roads, fences, stock watering tanks, and the existing pipeline through the desert east of Ehrenberg to just east of the Yuma/Maricopa county line boundary.

The Arlington Wildlife Area above Gillespie Dam on the Gila River is administered by the state. The Gila River Greenbelt Area includes all Federal lands in the Gila River floodplain from Phoenix to the Yuma county line. Both areas are extensively used for recreational activities, particularly hunting of quail and dove.

An approximate 1-mile linear portion of the Coronado National Forest in Cochise County is traversed by the existing El Paso Natural Gas Company pipeline. There are no developed areas or areas where the corridor would restrict existing public uses or management programs for grazing wildlife or other purposes.

Other areas within 10 miles of, but not directly traversed by, the proposed route include the Casa Grande National Monument (5.5 miles north), the Coronado National Forest in Pima County (the line runs parallel to the northeast boundary), and the Fort Bowie National Historic Site which is located approximately 10 miles south of the existing alignment. Existing uses are limited to grazing and recreation. Some speculative subdivision has occurred in the vicinity of Fort Bowie and Chiricahua National Monument several miles to the south.

New Mexico

No Federal or state preserves or refuges are located along the proposed alignment in New Mexico, except for the National Resource Lands administered by BLM or lands administered by the New Mexico State Land Commissioner.

Federal or state preserves within 10 miles of the proposed alignment are the Gila National Forest (7 miles north) and the Rock Hound State Park in the Little Florida Mountains (10 miles southeast).

Texas

From New Mexico into Texas, the existing line stretches across the northern edge of Franklin Mountains Wilderness Area. It crosses Fort Bliss Military Reservation which lies northeast of El Paso. Before leaving the county, the pipeline passes within several hundred feet of the southwest corner of the Hueco Tanks State Park and crosses the access road from U.S. Routes 160 and 82 to the park.

In Hudspeth and Culberson counties, the pipeline follows the southern boundary of Guadalupe Mountains National Park and passes within 200 feet of the extreme southeastern corner of the park. No other Federal or state preserves are noted along the rest of the route to Midland.

2.1.12.3 Recreation and recreational values

Recreation resources: southern California coast and Port of Long Beach

Description of the recreation resources potentially impacted by tanker traffic and oil spills at sea will be treated in summary fashion by county, with a more detailed description of recreation resources in the San Pedro Bay area potentially impacted by the Port of Long Beach tanker-pipeline interface (Figure 2.1.12.3-1 and Map 2.1.12-A, Attachment 1).

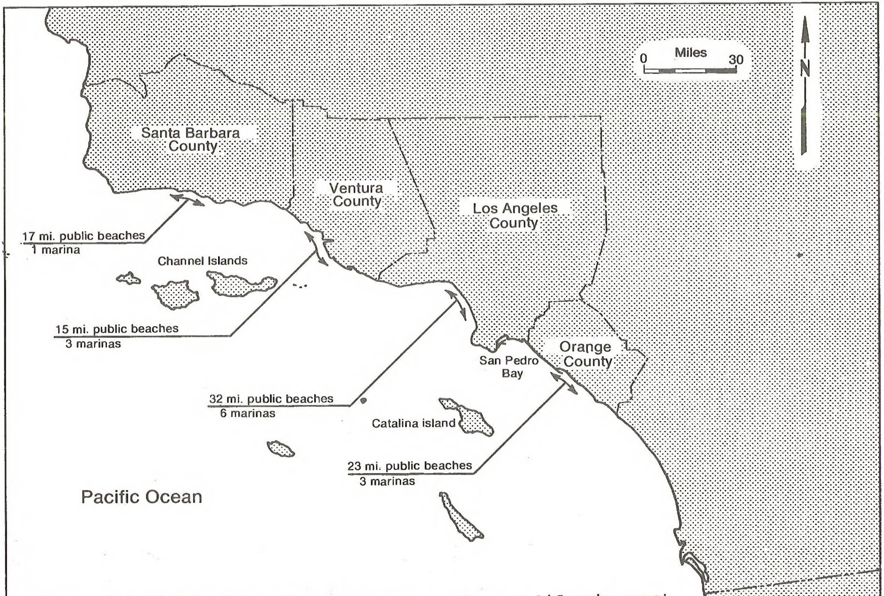


Figure 2.1.12.3-1 Recreation resources-southern California coast

Santa Barbara County. Only 17 miles of Santa Barbara County's 110-mile coastline is open to public recreational use. Seven state beaches and five city and county beaches provided 1,196,059 recreation days use in 1969 with the California Department of Parks and Recreation estimating a total recreation use of 3,626,100 recreation days by 1980. A recreation day is defined as one person's use of the facility for one day.

The coastal area from Point Conception to Gaviota State Park presently receives very little recreational use onshore due to lack of access.

Gaviota, Refugio, and El Capitan state beaches provide 6.5 miles of beach from Gaviota State Beach to Ellwood for recreational activities such as sunbathing, swimming, picnicking, camping, surfing, surf fishing, skin diving, jogging, beachcombing, and bird-watching. Two state, four city and county beaches, and the University of California at Santa Barbara allow public access to more than 10 miles of coastline between Ellwood and Carpinteria. Goleta Slough and Coal Oil Point Reserves receive heavy nature study usage from various public groups.

Surf, rock, and pier fishing, skin diving, scuba diving, crabbing, lobster trapping, and spearfishing all occur along the coast. Popular surf fishing areas include El Capitan, Refugio, Carpinteria, Goleta, and Gaviota state beaches. Goleta Point and Carpinteria are popular rock fishing sites. The Department of Fish and Game reported 187,500 angler days by sports fishermen in 1970; they estimate an annual average of 236,300 angler days usage by 1980. Santa Barbara Harbor is the only major party boat harbor and marina. Party boats fish the coastal and Channel Island waters while skiff fishermen fish inside the large offshore kelp beds and the waters off Point Castillo (Santa Barbara Harbor).

Three Channel Islands, San Miguel, Santa Rosa, and Santa Cruz, are located off the coast of Santa Barbara, but because of private and military ownership, very limited onshore public access is allowed, making their

primary recreational uses offshore party and private boat fishing, skin diving, and spearfishing. The islands are a scenic backdrop for mainland beaches.

Ventura County. More than 15 miles of Ventura County's 26-mile coastline are available for public recreational use in five state beaches and parks, and city and county parks. The California Department of Parks and Recreation projects the number of coastal recreation days to total 8,216,600 by 1980 in Ventura County.

Recreation activities at Emma Wood, Ventura, San Buenaventura, and McGrath state beaches and Point Mugu State Park include camping, picnicking, jogging, beachcombing, sunbathing, swimming, surfing, bird-watching, skin diving, etc. Surfing is one of the major recreation activities with heavy use at Punta Gorda, Hobson County Park, and Bass Rock.

Sport fishing, including spearfishing, surf fishing, and rock fishing, and clamming, skin diving, and abalone diving, are all undertaken along the coast. Pismo clam beds are located near Sea Cliff and near Ormond Beach; Littleneck clam beds are found near Pitas Point and near Sea Cliff. Fishing piers located at Ventura Beach, Channel Islands Marina, and Port Hueneme provide more than 100,000 angler days annually.

Party boats at Ventura Beach, Channel Islands Marina, and Port Hueneme provide an estimated 50,000 angler days of recreation. The Department of Fish and Game reported an annual average (1970) of 662,500 angler days from ocean fishing with 834,800 projected by 1980.

The Anacapa Islands of the Channel Islands National Monument provide both scenic and recreational value to boaters, shore fishermen, and divers alike. A ferry runs to the islands from the Channel Islands Marina.

Los Angeles County. Los Angeles County, the most heavily used coastal recreation county in southern California, had 76,770,974 visitors to its coastline in 1971. California Department of Parks and Recreation estimates a visitor level of 90,533,600 by 1980. Ten state beaches and nine city and county beaches comprise 32 miles of Los Angeles County's 74-mile coastline available for public recreation.

The Malibu area from the Ventura County line to Santa Monica is a resort-recreation area with high-density shoreline developments blocking public access to major shoreline beaches except for Leo Carrillo, Zuma, Point Dume, and Corral state beaches and several county beaches. Malibu is noted for surfing, swimming, sunbathing, surf fishing, skin diving, photography, beachcombing, etc.

From Santa Monica south to Torrance, the shoreline is almost entirely in public ownership with six state and five county beaches; much of the strip of land adjoining the coast has high-density residential, commercial, or industrial uses. Major marinas are located at Marina del Rey and King Harbor. In 1971, 52 million recreationists in the Santa Monica-Torrance coastal strip participated in sunbathing, swimming, surfing, surf fishing, jogging, beachcombing, picnicking, etc.

Royal Palms State Beach and Cabrillo County Beach on the Palos Verdes Peninsula receive about 1.5 million annual visitors. Marineland, a private aquarium and major tourist attraction, is located near Point Vicente. The Palos Verdes Peninsula is a scenic, open-space area having opportunities for bicycling, strolling, bird-watching, photography, rock fishing, and skin and scuba diving, as well as sunbathing, swimming, surfing, and picnicking.

Santa Catalina Island affords excellent recreational opportunities for both pleasure craft, fishermen, and skin and scuba divers. Santa Catalina Island, a privately owned nature conservancy open to the public, has long been known as a resort with unique sight-seeing opportunities. Visitors

account for an increase from average population of 1,520 to 6,000 during the summer to 10,000 on vacation weekends. Boats to Santa Catalina Island leave from Long Beach and Los Angeles harbors and Newport Beach.

Six major harbors and 11 piers support party boat operations, skiff and pleasure craft usage, and pier fishing. There were more than 250,000 party boat anglers in 1969. Numerous beach and rock areas afford good fishing spots. Grunion run along the sandy beaches of Santa Monica Bay, Cabrillo Beach, and Belmont Shores. In 1970, the Department of Fish and Game estimated 2,875,000 angler days usage for Los Angeles County with more than 3,622,500 angler days per year projected by 1980.

San Pedro Bay -- Los Angeles County. San Pedro Bay, encompassing Los Angeles and Long Beach harbors, includes not only commercial shipping facilities, but recreational facilities as well (Figure 2.1.12.3-2 and Map 2.1.12B, Attachment 1).

Los Angeles Harbor contains a 3,200-berth marina, plus 425 boats per day launching capacity. A portion of Cabrillo County Beach within Los Angeles Harbor has .5-mile of beach. A number of deep-sea fishing party boats berth at marinas in San Pedro Bay, as well as the Catalina Island cruise ships.

Long Beach Harbor berths the Queen Mary, a major tourist attraction. A major theme tourist amusement park called Pleasure Island has been proposed for the area east of Pier J and south of the Queen Mary. The Long Beach Marina at Terminal Island berths 2,380 boats and can launch 675 boats per day. The Golden Avenue ramps in Long Beach can launch an additional 200 boats per day.

Although the Port of Long Beach has fenced off most of the docks and piers from public use (for operational and security reasons), the eastern edge of Pier J south of the Queen Mary is presently a popular sport fishing area. Here, public parking is permitted within a reasonable walking distance of

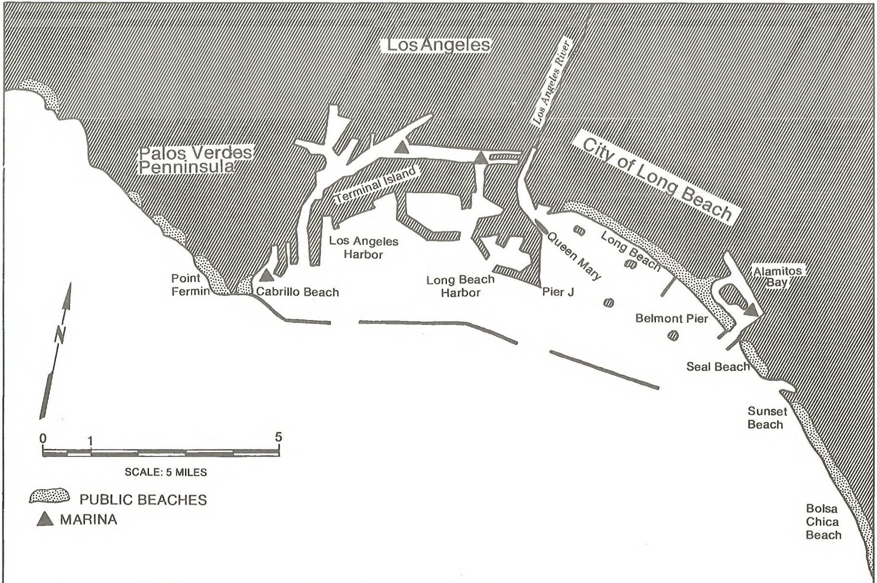


Figure 2.1.12.3-2 Recreation resources -- San Pedro Bay

approximately 1,500 yards of the shoreline. Although limited by the lack of nearby public parking, public fishing is not prohibited along approximately 1,800 yards of the southern shoreline of Pier J and 1,500 yards of shoreline on either side of the Queen's Way Bridge within the Port of Long Beach.

San Pedro Bay, east of Pier J, is a popular pleasure-boating area for sailboats, speedboats, and fishing boats. The breakwater affords good boat-fishing opportunities.

The shoreline of Long Beach from the Los Angeles River to the San Gabriel River represents 5 miles of public beaches. Recreational use was 16 million visitors in 1969. A major city park, Pacific Terrace Shoreline Park, is being developed near the Queensway Bridge with a pavilion, conservatory, amphitheater, amusement center, wharf for fishing, boating docks, sailboat rentals, picnic areas, and beaches for swimming. The Municipal Auditorium and Sports Arena is also located near the Pacific Terrace Shoreline Park.

Eastward down the beach is the Belmont Pier for fishing and the picturesque Belmont Shores-Naples area. The Long Beach Marina and Marine Stadium, and Alamitos Bay State Beach are located at the San Gabriel River mouth. A bicycle path/pedestrian promenade will follow the shoreline west from Alamitos Bay State Park to the Los Angeles River channel. The Long Beach Marina has 1,850 berths and a launching capacity of 425 boats per day. A number of private restaurants and hotels orient to San Pedro Bay as a major amenity.

The Long Beach City Planning Department also recommends that when use of the four offshore artificial oil islands ceases (around the year 2000), they should become docking facilities. Proposed private recreational facilities include two marinas adjacent to the Queensway Hilton Hotel on Pier J.

Orange County. Only 23 miles of Orange County's 42-mile coast are open to public use. This is represented by 8 miles of state beach and 14 miles of

city and county parks including Newport, Seal, Huntington, and Coast Royal beaches. Recreation activities include sunbathing, swimming, surfing, picnicking, scuba and skin diving, beachcombing, strolling, bicycling, bird-watching, sports fishing, camping (state beaches), etc.

The entire beach area from Seal Beach south to Newport Beach is accessible to the public. Recreation use for this stretch was 20,961,350 visitor days in 1974. Thousands of surfers use the area between Seal and Newport beaches because of favorable surf and beach conditions.

Bolsa Chica marsh supports heavy bird-watching use. Clammers dig for Pismo clams in beds located off Bolsa Chica and Huntington beaches. Grunion lay their eggs on Seal, Huntington, Newport, Corona del Mar, and Doheny beaches, and are caught by thousands of persons who come to participate in the grunion runs.

Sport fishing in 1970 accounted for 2,700,000 angler days in Orange County. The California Department of Fish and Game estimates an average 3,400,000 angler days per year by 1980 in Orange County. Party boats operate out of five major harbors in Orange County. Sunset Beach, Huntington Beach, Newport Beach, Balboa Beach, and San Clemente Harbor all support not only heavy party-boat use, but pier (Sunset, Huntington, and San Clemente), skiff, and boat fishing areas.

Recreation resources: greater Los Angeles urban area

Description of the recreation resources in the greater Los Angeles urban area will be limited to highlighting those areas traversed or otherwise potentially impacted by the proposed project, including power-line extensions.

Los Angeles County. The proposed pipeline route from Pier J in Long Beach Harbor through Los Angeles County follows the flood control channels of the

Los Angeles River, Rio Hondo, San Jose Creek and the Whittier Narrows Dam. These channelized watercourses are components of a comprehensive pedestrian, bicyclist, and equestrian trail system of the Los Angeles County Parks and Recreation Department and the U.S. Army Corps of Engineers (Figure 2.1.12.3-3 and Map 2.1.12C in Attachment 1).

Recreation along the pipeline route is described in detail in "The Lower Rio Hondo Channel and the Los Angeles River Recreation Master Plan," dated February, 1976, and the "Revised Recreation Master Plan for Whittier Narrows Flood Control Reservoir," dated December, 1974. The following is taken from information in these master plans.

Los Angeles River-Rio Hondo channels. Numerous recreational facilities are adjacent to the proposed pipeline project. Existing parks adjacent to the Los Angeles River and Rio Hondo channels include:

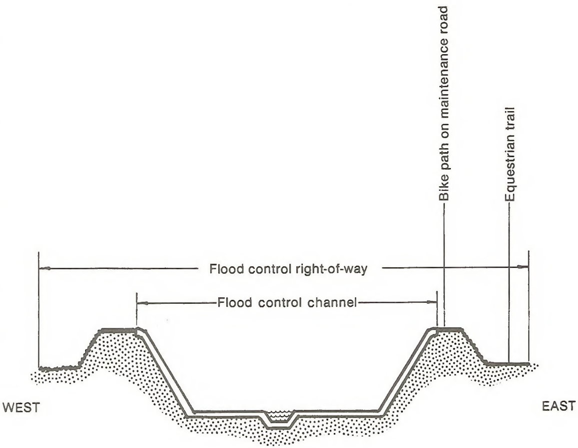
1. Palm Beach, Santa Cruz, and Deforest city parks and the Virginia Country Club (private golf course), all in the city of Long Beach and east of the Los Angeles River channel.

2. Compton Par 3 Golf Course (public) in the city of Compton east of the Los Angeles River channel.

3. Circle City Park in South Gate east of Rio Hondo channel.

4. Crawford City Park and Rio Hondo Country Club (private golf course) in the city of Downey and east of the Rio Hondo channel.

5. John A. Ford County Park and Treasure Island and Quigley city parks, all in the city of Bell Gardens and west of the Rio Hondo channel.



Typical cross section—Los Angeles River

Figure 2.1.12.3-3 Recreation resources-flood control channels

6. Rio Hondo and Grant Rea city parks, respectively, east and west of the Rio Hondo channel in the city of Pico Rivera.

Five existing equestrian stables are situated along the flood control project borders. These parks and stables are adjacent to, but outside, the flood control and pipeline rights-of-way. A designated bicycle trail exists on the east side of the Los Angeles River from Willow Street to Imperial Highway, utilizing the paved service road atop the levee. The existing paved service road running from Imperial Highway to Whittier Narrows Dam is currently being used for limited, unauthorized bicycling and hiking. An equestrian trail extends from Willow Street on the Los Angeles River to Florence Avenue on the Rio Hondo, running on the east side of the channel behind the levee, and from Telegraph Road to Whittier Narrows Dam on the west side of the channel behind the levee.

<u>Whittier Narrows Dam area</u>. Streamland Park, situated at the downstream base of Whittier Narrows Dam (Map 2.1.12-C in Attachment 1), is an existing 9.6-acre park that is currently undergoing further development. Just east of Streamland Park is the nine-hole Pico Rivera Golf Course. A 100-acre equestrian area is currently under construction north of the dam levee and south of the San Gabriel River. The camping area and an entrance road (Rooks Road) over the levee from the San Gabriel River Parkway are nearing completion. After crossing the levee, the road runs parallel to and between the levee and the parkway until it connects with the latter near Cliota Street. The Whittier Narrows Dam recreation area north of the dam has been developed with picnic areas, nature and wildlife areas, and recreational lakes. Equestrian and bicycle trails extend up the San Gabriel River channel to Whittier Narrows Dam, with the equestrian trail continuing northeastward between the dam levee and San Gabriel River Parkway and then crossing over the levee into the equestrian

area. The bicycle trail on the west side of the San Gabriel River channel extends over the top of the dam to the reservoir area.

The proposed pipeline is also routed adjacent to the following recreation areas:

1. California Country Club, a private golf course in the City of Industry north of San Jose Creek channel.

2. Diamond Bar Golf Course, a county park adjacent to the Diamond Bar development areas, skirted on the east by the pipeline.

San Bernardino and Riverside counties -- Diamond Bar to Redlands. The proposed pipeline corridor largely follows utility corridors through San Bernardino and Riverside counties. The pipeline crosses approximately 4 miles of the Puente Hills grasslands with significant open-space value (see Section 2.1.10.3 Visual resources). The Chino Junior Fairgrounds is immediately north of a small segment of the proposed pipeline. The pipeline follows 3 miles of the unchannelized Santa Ana River, which has some open-space values despite urban encroachment and gravel extraction (see Section 2.1.10.3 Visual resources).

San Timoteo Canyon has two private recreational fishing lakes-camping complexes (open to public use for a fee), and is a valuable open-space area (see Section 2.1.10.3 Visual resources). Hiking and equestrian trails are crossed in San Bernardino County at San Antonio-Chino Creek Channel, Cucamonga Creek Channel, Santa Ana River Channel, Jurupa Mountains, Reche Canyon, and San Timoteo Canyon.

Recreation: California desert

Figure 2.1.12.3-4 has general data and Maps 2.1.10-3, 2.1.10-4, and 2.1.10-5 (Attachment 1) present more detailed information on California desert recreation. The pipeline corridor traverses the California desert from San Gorgonio Pass to the Colorado River. Except for largely private lands in the Coachella Valley (Palm Springs area) and Palo Verde Valley (Blythe area), and the National Park Service lands of Joshua Tree National Monument, most of this desert area is public domain administered by the Bureau of Land Management. The California desert is in proximity and readily accessible to the greater Los Angeles metropolitan area. Major use of these lands is recreation, which has a diversity of forms ranging from motorized recreational vehicles to backpacking and from picnicking and sight-seeing to rock hounding and nature study.

Recreational abuse of the California desert environment from off-road recreational vehicles has caused irreparable damage to scenic, natural, geologic, and archaeologic values. Therefore, BLM adopted in 1974 an Interim Critical Management Program for vehicle use in the California desert. The California Desert Vehicle Program designated areas as closed, open to vehicle use, or restricted. Vehicular use in restricted areas is limited to existing roads and trails. Under the restricted area designation, special design areas require additional planning to adequately accommodate recreation vehicles and protect other resource values; while areas labeled "designated roads and trails" may be further limited in the future.

Bureau of Land Management California desert lands north of Interstate 10, adjacent to Joshua Tree National Monument, and on the Palo Verde Mesa west of Palo Verde Valley, restrict vehicles to established roads and trails. The Chiriaco Summit area (south of Interstate 10) and a major portion of the Chuckwalla Valley (north and south of Interstate 10) are open to recreational vehicle use. Because of high resources values, areas where

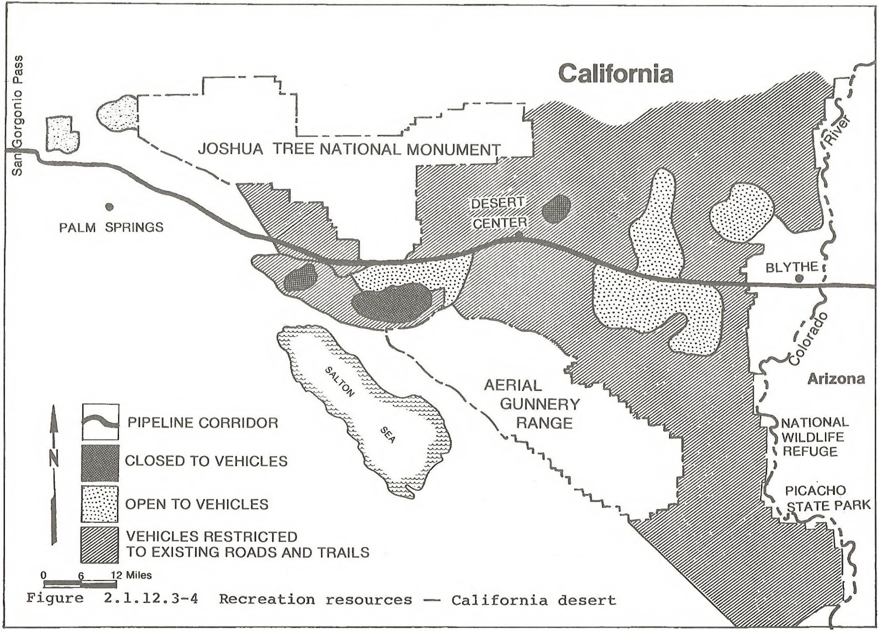


Figure 2.1.12.3-4 Recreation resources — California desert

recreational vehicle use will be restricted to designated roads and trails include the Mecca Hills, Orocopia Mountains, Chuckwalla Mountains, and portions of Chuckwalla Valley north of Desert Center. Use of this portion of the California desert is relatively high.

Joshua Tree National Monument. The pipeline passes close to the southern boundary of Joshua Tree National Monument (less than 1 mile for approximately 6 miles near Chiriaco Summit). Joshua Tree National Monument encompasses an area of high and low desert with several desert mountain ranges and many stands of picturesque Joshua trees (an arborescent yucca). Much of the park area outside of paved roads and developed facilities is proposed for wilderness classification.

San Bernardino National Forest. The pipeline corridor through the San Gorgonio Pass is within 2.5 to 3.5 miles of two blocks of the San Bernardino National Forest (the Santa Rosa and San Bernardino mountains).

Other Recreation Areas. Developed public recreational areas within several miles of the pipeline corridor are limited to county parks 2 miles north of Beaumont in the San Bernardino Mountain foothills and 5 miles south of Blythe on the Colorado River; city parks in Beaumont, Banning, Indio, and Blythe; and roadside rest areas on Interstate 10 at Palm Springs-White Water, and Cactus City (15 miles east of Indio) and Wiley Springs roads (10 miles east of Blythe).

Colorada River. The river is a major water-based recreation resource for surrounding arid deserts in California and Arizona. From Parker Dam north of Blythe, one could float approximately 80 miles downstream to Imperial Dam, near Yuma, passing through Cibola and Imperial National Wildlife Refuges and past Picacho State Park (California). Much of the shoreline along the river is Federal land acquired by the Bureau of Reclamation during channelization. Recreational use of Federal lands outside the National Wildlife Refuges is managed by the BLM Yuma District Office. Major marinas

are found at Blythe in Queshan Park and Martinez Lake near Imperial Dam with boat launch ramps at the end of several county roads on the California side, as well as Picacho State Park and McIntyre County Park. Water skiing is popular in the area upstream of Cibola National Wildlife Refuge and downstream of Imperial National Wildlife Refuge. Safe swimming beaches are found at Quinshan Park (Blythe), McIntyre Park, Picacho State Park, and Martinez Lake. There are numerous second homes or retirement homes outside of Blythe and at Ehrenberg along the river. The river and its numerous backwater lakes affords good fishing and fine waterfowl hunting opportunities.

Arizona

Description of the recreation resource will be limited to highlighting those areas traversed or otherwise potentially impacted by the proposed project, including extension of power lines. Figure 2.1.12.3-5 shows general data, and attached Maps 2.1.10-6, 2.1.10-7, and 2.1.10-8 in Attachment 1 have more detailed information.

Ehrenberg. The area, traversed by pipeline corridor, south of Interstate 10 between Colorado River and Dome Rock Mountains, is a popular sight-seeing area, with recreational vehicle users on primitive roads in winter, and a new roadside rest area with interpretive signing on Interstate 10. It is also a popular dove hunting area.

Dome Rock Mountains. This range, traversed by the pipeline corridor, attracts recreational vehicle use on primitive roads, including the existing pipeline corridor, during winter months. Backpackers, rock-climbers, and big-game hunters may sight desert bighorn sheep.

La Posa Plain. The area south of Quartzsite, traversed by the pipeline corridor, is a popular winter camping area for "snowbirds" -- retired persons who live in self-contained recreational motor homes and pickup

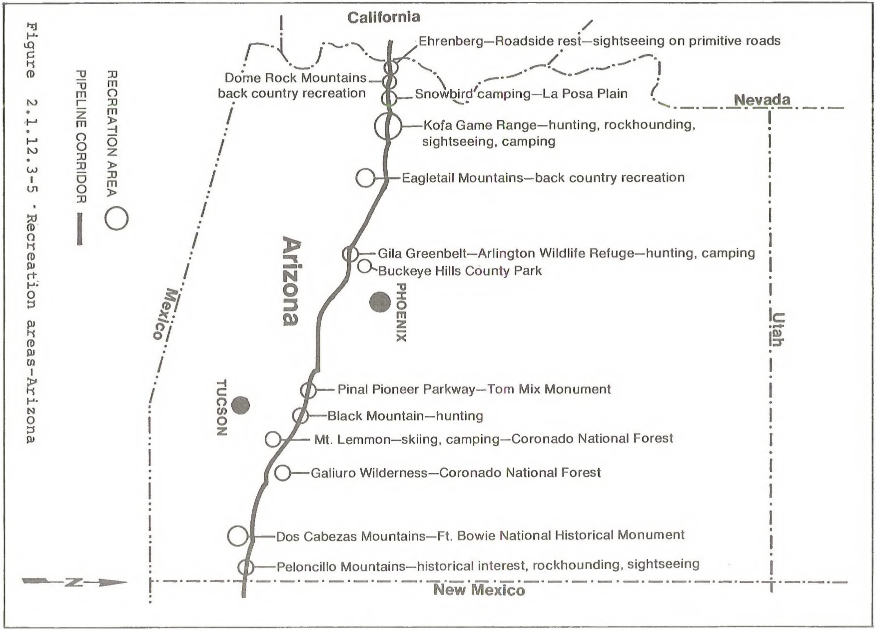


Figure 2.1.12.3-5 · Recreation areas-Arizona

campers, and winter on the Arizona desert away from snow. The existing pipeline corridor is used by these persons for camping access.

Kofa Game Range. This game range, established to protect desert bighorn sheep habitat, is traversed by the pipeline corridor. The area possesses high scenic, wilderness, and historic (mining) values and is a popular rock-hounding and desert-flora photography area. The Crystal Hills campground located within the game range has approximately 60 developed sites and is filled by more than an estimated 100 trailer/camper units in winter months. This campground was developed by the Bureau of Land Management to alleviate the uncontrolled visitor-use pressures on the fragile desert terrain.

Eagletail Mountains. This range, 1 to 3 miles south of the pipeline corridor, has high scenic quality and receives moderate hiking and backpacking use with potential for primitive or natural area designation, according to the Arizona Academy of Sciences (1974). The pipeline traverses the bajada (pediment) to the north of this range.

Saddle Mountain. This area, 3 to 5 miles north of the pipeline corridor receives moderate recreational vehicle use on trails and picnicking and camping at BLM developed primitive facilities.

Arlington Wildlife Refuge. The refuge above Gillespie Dam on the Gila River is .5-mile upstream of the pipeline corridor crossing of the Gila River. Dove, quail, and waterfowl hunting as well as bird-watching are recreational pursuits at the refuge.

Gila River Greenbelt. This thicket of mesquite and salt cedar with potholes along the Gila River from Gillespie Dam downstream 100 miles to Yuma, is a major dove, waterfowl, and quail hunting area and a popular bird-watching and camping area. The greenbelt is traversed by the pipeline corridor at upstream end.

Buckeye Hills County Park. This park, 2 miles north of the pipeline corridor, is a popular day-use recreation area serving the Phoenix metropolitan area.

Picacho Reservoir. The existing pipeline crosses the Florence-Casa Grande canal which feeds the Picacho Reservoir, a popular warmwater fishery and waterfowl hunting area.

Pinal-Pioneer Parkway/Tom Mix Monument. U.S. Route 80 is a designated scenic highway, with interpretive signs identifying desert flora, and roadside ramadas. The Tom Mix Monument commemorates the cowboy movie actor of the 1920s and 1930s who was killed in an automobile accident on U.S. Route 80. The pipeline corridor traverses the parkway .5-mile northwest of the monument and the associated roadside ramadas.

Black Mountain area. The pipeline corridor traverses a popular dove and quail hunting area, largely in state ownership.

Coronado National Forest. The existing pipeline crosses foothills of the Winchester Mountains of the Coronado National Forest. As there is no public access road to this block of national forest, the area receives little public recreational use other than hunting. The pipeline corridor is 6 to 10 miles or more from the Mt. Lemmon recreation area (skiing, camping) in the Santa Catalina Mountains of the Coronado National Forest. The pipeline corridor is 8 to 10 miles or more from the Galiuro Mountains Wilderness Area of the Coronado National Forest.

Dos Cabezas Mountains. This range, immediately south of the pipeline corridor, was a refuge for the Chiricahua Apache. Hunting, rock-hounding, sight-seeing, backpacking, and horseback riding are now popular activities. Fort Bowie National Historic Site is located at Apache Pass on the historic Butterfield Stage route, 10 miles south of the pipeline. The pipeline traverses the bajada to the north of this range.

Peloncillo Mountains. This range on the New Mexico border is rich in the romantic western lore of Apache ambushes of the pre-Civil War Butterfield Stage. The existing pipeline corridor has obliterated a portion of this historic route through the Peloncilla Mountains. The area is also popular with rock hounds.

Recreation resources -- New Mexico

Description of the recreation resource will be limited to highlighting those areas traversed or otherwise potentially impacted by the proposed project, including transmission lines.

The existing pipeline corridor does not traverse any designated park or recreation area in New Mexico. However, the existing pipeline corridor passes close to several park and recreation use areas. Figure 2.1.12.3-6 presents general recreation data, and Maps 2.1.10-9, 2.1.10-10, 2.1.10-11, and 2.1.10-12 (Attachment 1) give more detailed information.

Shakespeare-Aberdeen Peak. This popular ghost town and historic mining area south of Lordsburg is 1 mile south of the existing pipeline corridor.

Rock Hound State Park. A popular rock-hounding area south of Deming and 3 miles south of the existing pipeline corridor, the park has developed camping and picnicking facilities.

Rio Grande. The existing pipeline corridor crosses private lands along the river which afford waterfowl hunting.

Red Bluff Reservoir-Pecos River. Most of this large reservoir is impounded in Texas, but it backs up into New Mexico 3 miles downstream of the Pecos River crossing of the existing pipeline corridor. The reservoir offers warmwater fishing and the river affords waterfowl hunting.

Figure 2.1.12.3-6 Recreation areas-New Mexico

The existing pipeline corridor traverses a number of other areas of dispersed recreational vehicle and hunting uses and affords access for these recreational uses.

Recreation Resources -- Texas

Description of the recreation resource will be limited to highlighting those areas potentially impacted by the proposed project including power-line extensions.

The pipeline corridor does not traverse any designated park or recreation area in Texas. (Figure 2.1.12.3-7 presents general recreation data, and Maps 2.1.10-10, 2.1.10-11, and 2.1.10-12 in Attachment 1 give more detailed information.) However, the pipeline corridor does pass close to several parks and recreation areas, namely:

Franklin Mountains Wilderness Park. Directly north of El Paso, this city park encompasses a rugged desert mountain range with hiking, backpacking, and nature study opportunities.

Hueco Tanks State Park. Thirty-five miles east of El Paso, this park is a desert oasis of tanks (ponds) and cottonwood trees set among monolithic reddish rock outcroppings. The park offers developed picnicking and camping facilities and hiking. The number and variety of petroglyphs and pictographs are outstanding. The pipeline corridor skirts the west and south boundaries of the park.

Guadalupe Mountains National Park. This park encompasses an "island" in the desert. It contains rocky, mountain-coniferous forests and a number of spectacular peaks and escarpments, including the highest point in Texas. The park offers nature interpretation and backcountry recreation opportunities. The pipeline corridor skirts the southern boundary of the park, crossing National Park Service lands which are outside the

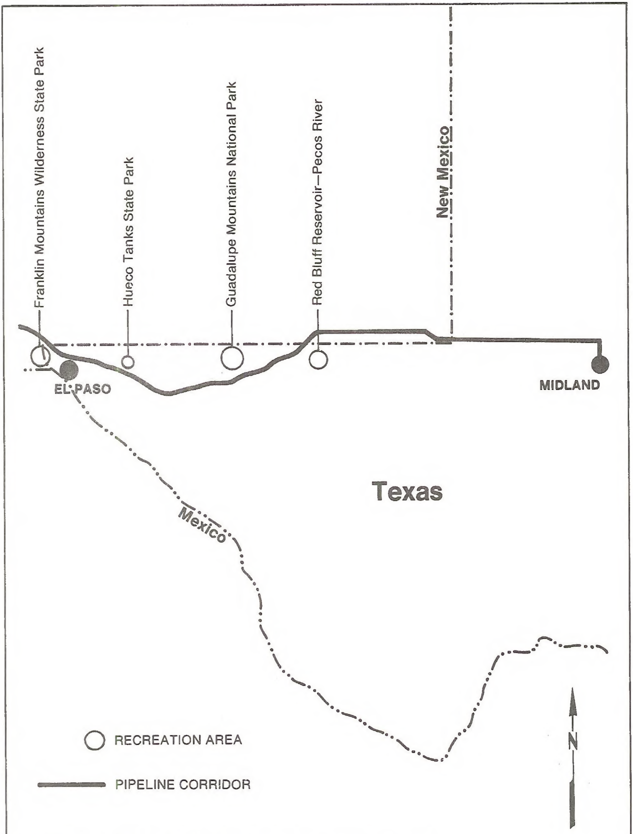


Figure 2.1.12.3-7 Recreation areas-Texas

Congressionally declared boundaries of Guadalupe Mountains National Park and hence surplus to park purposes.

Red Bluff Reservoir (Pecos River). The inlet of this reservoir is 3 miles downstream of the point where the pipeline corridor crosses the Pecos River. The dam is located 11 miles downstream. The reservoir offers boating, fishing for warm water species, swimming, and water-skiing opportunities, as well as developed camping and picnicking facilities.

The existing pipeline corridor traverses a number of other areas of dispersed hunting and recreational vehicle uses, with the pipeline corridor affording access.

Midland. The proposed terminal is located in an existing industrial tank farm east of Midland near agricultural lands. No recreation resource lands are located in proximity to the proposed terminal.

2.1.12.4 Agriculture and grazing

There is extensive and diversified agriculture along certain portions of the pipeline route from the Los Angeles Basin to Blythe, including field crops, vegetable crops, fruit, horticulture, poultry, livestock, and dairy products.

In 1974, Los Angeles County had 247,891 acres of land in agricultural production; San Bernardino County had 90,574 acres in cropland; and Riverside County had 353,479 acres in agricultural production.

Increasing urbanization has threatened agricultural land by both fringe and noncontiguous development. More than 90 percent of the expansion in Los Angeles, Orange, Riverside, and Santa Clara counties in the last decade utilized cropland, averaging about 14,000 acres per year. Much of this land was prime, high-production agricultural land and has been buried under

shopping centers, subdivisions, and thoroughfares. Population increases have caused more intensive use and haphazard development of land. Consequently, urban and industrial developers have outbid agriculture for land requirements.

Agriculture in the southwestern states of Arizona, New Mexico, and Texas is presently maximum. There may be limited expansion on a local basis (i.e., resurrection of fallow fields along the Colorado River).

2.1.12.5 Minerals

Port of Long Beach area

Mineral resources. Faulting and warping of the tertiary sediments locally have formed traps in which pools of oil have accumulated. The Wilmington oil field, located partly in the Long Beach Port area, is reputed to be the No. 1 producing oil field in the continental United States, yielding over 230,000 bbl/d. No other marketable resources are currently known to exist in the area.

The quarry on Catalina Island has been in existence for several years. Much of this rock has been used to armor-plate the existing breakwater and other facilities within San Pedro Bay. The quarry site is exempted from the open-space zoning that encompasses much of the island. An expansion of the quarry on the south end of the island will be necessary for the proposed breakwater at Pier J. This will require a permit from the California Coastal Commission.

Pipeline route

The pipeline route would traverse land areas where common variety minerals (i.e. sand, gravel, and rock) are being mined at present. These areas occur sporadically from Pico Rivera eastward to Redlands. Public domain lands have been extensively utilized for mining claim locations under the Mining Act of 1872. The route would not traverse any area of mineral production except for scattered locations of sand and gravel mining in eastern California, Arizona, and New Mexico. In addition, there are no known explorations for potential mining operations along the proposed route.

Oil and gas have been actively produced for many years in eastern New Mexico and western Texas including the Midland area. Declines in the Permian Basin are fully addressed in the Energy Supply/ Demand Report prepared for BLM by Environmental Research and Technology, Inc.

2.1.12.6 Urban areas

California

Los Angeles County. Most urban development in Los Angeles County has been confined to the gentle slopes and mild climate of the coastal lowlands. Covering only one-fourth of the county area, the coastal lowlands contain 98 percent of its population. The total urbanized area in the county covers over 1,030 square miles (660,000 acres). The mountains, desert, and Channel Islands, covering three-fourths of the county area, contain only 2 percent of its population. Los Angeles County is composed of 78 incorporated cities and various unincorporated areas.

The land use in the proposed pipeline corridor across Los Angeles County is predominantly urban. Agricultural use is limited to random parcels.

The description of the land use adjacent to or traversed by the proposed pipeline route, for Los Angeles County, is presented in Table 2.1.12.6-1, which includes approximate percentages of each land use category. For purposes of discussion, the description is divided into two major segments: (1) Port of Long Beach to the flood control basin at Whittier Narrows, and (2) the flood control basin to Diamond Bar. Special features within the corridor and their proximity to the proposed route are shown in Table A2.1.12.6-1.

Port of Long Beach to flood control basin -- From the Port of Long Beach to the flood control basin, following the Los Angeles River and the Rio Hondo rights-of-way, the land use on either side of the proposed pipeline route is predominantly residential. The initial 3.0 miles are industrial, but the next 17.0 miles to the flood control basin are primarily residential. The land use adjacent to and on both sides of the proposed pipeline route within these two areas is mixed and is shown on Table A2.1.12.6-1. Where adjacent power-line rights-of-way and transportation corridors are the sole barrier between the proposed route and a land use area, the land use area likewise has been considered adjacent to the proposed route, and the percentage has been included in the calculations.

The municipalities adjacent to or traversed by the proposed pipeline route within this 20.0-mile segment, following the Los Angeles River and Rio Hondo rights-of-way to the flood control basin, are listed in Table 2.1.12.6-2 with approximate mileages and populations.

Table 2.1.12.6-1

Land Use Along Proposed Pipeline Route Through California

	West											East
	Los Angeles County						San Bernardino County	Riverside County				
	Pier J to Flood Control Basin		Flood Control Basin to Pomona			Pomona to County Line	San Bernardino County	County Line to Beaumont	Beaumont to Palm Springs	Palm Springs to Indio	Indio to Hell	Hell to the Colorado River
Approximate mileposts												
Approximate mileage	3.0	20.2	3.5	2.0	15.0	4.0	40.5	16.0	21.0	27.0	57.5	41.5
Dominant land use	Indus-trial	Resi-den-tial	Rec-rea-tional	Resi-den-tial	Agri-cultur-al	Urban	Agricultural	Open space	Open space	Open space	Open space	Open space
Approximate Percentage of Land Use Category[a] Northern Half/Southern Half												
Urban	NA[b]	NA	NA	NA	NA	55/19	8/11	--[c]	10/10	--	--	--
Industrial	100/50	24/14	--	0/37	46/26	10/10	2/0	--	2/9	1/0	--	--
Residential	--	29/38	--	47/45	1/2	NA	NA	--	NA	--	--	--
Commercial	0/15	6/1	--	--	2/3	NA	NA	--	NA	--	1/1	--
Institutional	--	1/1	--	--	--	--	7/7	--	--	--	--	--
Other urban	0/9	35/34	--	39/18	7/1	--	2/3	0/2	--	4/4	--	--
Agricultural	--	--	--	2/0	43/68	--	58/62	17/20	17/14	1/1	--	27/27
Extractive	--	0/2	--	--	--	--	1/0	--	--	--	--	--
Park and recreation	0/15	5/10	100/100	6/0	--	--	1/0	--	0/1	--	--	--
Open space	0/11	--	--	6/0	1/0	35/71	21/17	83/78	49/49	87/88	99/99	73/73
Indian Reservation	--	--	--	--	--	--	--	--	22/17	7/7	--	--

a "Northern half" refers to the side of the proposed pipeline route generally facing the northern half of each base map; "southern half" refers to the side of the proposed pipeline route generally facing the southern half or each base map.

b NA Not applicable.

c Represents zero.

Table 2.1.12.6-2

Municipalities Adjacent to or Traversed by Pipeline Route,

Los Angeles County

MUNICIPALITY	Approximate Miles Adjacent or Traversed	1970 Population
Bell Gardens	1.4	29,308
Commerce	0.2	10,536
Compton	0.6	78,611
Diamond Bar	1.5	5,000
Downey	2.4	88,445
Industry	8.5	714
Long Beach	10.4	358,633
Lynwood	1.3	43,353
Montebello	2.4	42,807
Paramount	2.1	34,734
Pico Rivera	3.1	54,170
South Gate	2.5	56,909

Approximately 5.6 miles of proposed route are adjacent to or traverse unincorporated areas.

Flood control basin to Diamond Bar -- From the flood control basin to Diamond Bar, traversing the flood control basin and following the San Gabriel River, Rio Hondo, and railroad rights-of-way, the land use on either side of the proposed pipeline route, for the most part, is agricultural. The proposed pipeline corridor traverses the flood control basin area for approximately 3.0 miles and the incorporated areas of Montebello, Pico Rivera, and City of Industry. The bulk of this segment is unincorporated. The primary land use in the flood control basin is recreation with some producing oil wells. Special features include the amusement park, the Whittier Narrows Wildlife Sanctuary, and the equestrian area.

The proposed pipeline route continues for approximately .5-mile adjacent to the San Gabriel River Channel to the junction of the San Jose Creek Channel. The primary land uses along the San Gabriel River and the initial mile of the San Jose Creek are residential. The area traversed by the proposed pipeline route through this 1.5-mile area is unincorporated.

The following 11.5 miles (approximately) of the proposed route parallels mixed agricultural and industrial uses with the first being the dominant land use. The municipalities adjacent to or traversed by the proposed pipeline route through this 11.5-mile area along the San Jose Creek and railroad rights-of-way are listed in Table 2.1.12.6-3 with approximate mileages and populations.

Table 2.1.12.6-3

Municipalities Along San Jose Creek and Railroad Rights-of-Way

MUNICIPALITY	Approximate Miles Adjacent or Traversed	1970 Population
City of Industry	8.5	714
Pomona	3.0	87,384

Approximately 1.9 miles of the proposed route, within this 11.5-mile area, traverses unincorporated areas.

The pipeline route crosses the Pomona region for approximately 4.0 miles. The land use adjacent to and on both sides of this proposed route is primarily urban.

San Bernardino County. The land use in the proposed corridor across San Bernardino County is predominantly agricultural. The major towns within the corridor are Chino, Ontario, Fontana, Rialto, Colton, San Bernardino, and Redlands. A special use within the corridor is the California Institution

for Men. The pipeline route crosses no scenic highways within the county. In San Bernardino County, the pipeline corridor generally will utilize power-line and railroad rights-of-way.

The description of the land use adjacent to or traversed by the proposed pipeline route, for San Bernardino County, is presented in Table 2.1.12.6-1, which includes approximate percentages of each land use category. Special features within the corridor and their proximity to the proposed route are shown in Table A2.1.12.6-2.

The municipalities adjacent to or traversed by the proposed route through the approximate 12.3 miles of San Bernardino County are listed in Table 2.1.12.6-4 with approximate mileages and populations.

Other urban areas traversed by the proposed route include Crestmore, Loma Linda, and Bryn Mawr.

Table 2.1.12.6-4

Municipalities Adjacent to or Traversed by Pipeline Route, San Bernardino County

MUNICIPALITY	Approximate Miles Adjacent or Traversed	1970 Population
Chino	2.4	20,411
Fontana	3.6	20,673
Colton	4.3	19,974
Redlands	2.0	36,355

Riverside County. The land use in the proposed corridor across Riverside County is predominantly open space. The major towns within the corridor are Riverside, Beaumont, Banning, Palm Springs, Indio, and Blythe. Agricultural use is limited to interspersed parcels in the valley portions of the county.

Urban areas are traversed in the vicinity of towns cited above. Special features within the corridor include the U.S. military reservation, the Morongo Indian Reservation, the Agua Caliente Indian Reservation, the Cabazon Indian Reservation, and Joshua Tree National Monument.

The description of the land use adjacent to or traversed by the proposed pipeline route for Riverside County is presented in Table 2.1.12.6-1, which includes approximate percentages of each land use category. For purposes of discussion, the description is divided into five major segments: (1) the county line to Beaumont, (2) Beaumont to Palm Springs, (3) Palm Springs to Indio, (4) Indio to Hell, and (5) Hell to the Colorado River. Special features within the corridor and their proximity to the proposed route are shown in Appendix Table A2.1.12.6-2.

County line to Beaumont -- From the county line to Beaumont, following railroad right-of-way and existing pipeline, the primary land use is open space. No incorporated towns or other urban areas are traversed.

One scenic highway is traversed by the pipeline route in this region. Interstate 10, crossed by the proposed route west of Beaumont, is considered a scenic highway to a point northeast of Palm Springs.

Beaumont to Palm Springs -- From Beaumont to Palm Springs, utilizing the Southern California Gas Company existing pipeline, the primary use is open space. The existing pipeline traverses the corporate limits of Beaumont and Banning for a distance of approximately 1.0 and 3.0 miles, respectively. The existing pipeline traverses 5 miles of the Morongo Indian Reservation.

In the Beaumont to Palm Springs region, the existing pipeline crosses scenic highways at two different points. Interstate 10 is considered a scenic highway to a point northeast of Palm Springs where the scenic highway turns north while Interstate 10 continues east. It is crossed once by the

existing pipeline. Another scenic highway, which runs north-south through Beaumont, is crossed by the existing pipeline.

Palm Springs to Indio -- From Palm Springs to Indio, utilizing the existing pipeline, the primary land use is open space. Incorporated towns or other urban areas are not traversed. The existing pipeline crosses 2 miles of the Agua Caliente Indian Reservation.

No scenic highways are traversed by the Southern California Gas Company pipeline in the region from Palm Springs to Indio.

Indio to Hell -- From Indio to Hell, utilizing the existing pipeline, the primary land use is open space. No incorporated towns or other urban areas are traversed.

The existing pipeline crosses scenic highways, in the Indio to Hell region, at three different points. The first crossing occurs west of Chiriaco Summit with California 195 stopping at Interstate 10 and the scenic highway continuing north through Joshua Tree National Monument. The second crossing, west of Desert Center, occurs as the existing pipeline crosses south of Interstate 10, which is again considered a scenic highway to a point east of Hell, where the third crossing occurs as the scenic highway turns south and Interstate 10 continues east.

Hell to the Colorado River -- From Hell to the Colorado River, the primary land use is open space. No incorporated towns or other urban areas are traversed; however, Blythe, with a population of approximately 7,000, is in the immediate vicinity of the pipeline corridor.

The proposed route traverses irrigated cropland south of Blythe. Within this region the initial 13.6 miles utilize existing pipeline, while the following 27.9 miles would be new construction.

No scenic highways are traversed by the proposed pipeline route in the region from Hell to the Colorado River.

Arizona

Four land use classifications were used to categorize existing land use: (1) open space, multiple use, and grazing land, (2) cultivated agricultural land, (3) developed land, and (4) transportation and utility rights-of-way.

The first type includes all open-space property, multiple-use land and all property improved for grazing. Cultivated agricultural land includes all forms of improved cropland, the majority of which is irrigated. Developed land includes all property with some evidence of urban development, such as residential and industrial subdivisions, mobile home parks, and institutional or public lands adjacent to urban areas. Transportation and utility rights-of-ways include both publicly owned and privately owned property used for public purposes; i.e., road and railroad right-of-way, irrigation and drainage systems, and riverbeds.

Existing use of Arizona land in the proposed pipeline corridor is mostly open space, multiple use, and grazing. Along the Colorado River in Yuma County there are irrigated fields, but in Maricopa County a total of 11.2 miles of croplands are found in the existing pipeline right-of-way. As seen in Table 2.1.12.6-5, open-space, multiple-use, and grazing lands across the proposed route comprise 84.3 percent of the total land crossed in the state. A small airstrip over the buried El Paso Natural Gas Company pipeline and the periodic compressor stations are the only interruption in the otherwise desolate stretch of land through the Kofa Game Range into Maricopa County. This section transects 9 miles of irrigated agricultural land and scattered residential pockets west of Centennial Wash. The line then passes eastward through more open grazing land.

Table 2.1.12.6-5

Land Use Analysis Along Existing Pipeline, Arizona
(As Percent of Totals)

OWNERSHIP	Land Use Classifications: Open Space Multi-Use Grazing	Cultivated Agriculture	Developed	Transp. Utility ROWs	Total
Yuma County					
United States	91.4			5.1	96.5
Arizona	1.2		1.6	0.1	2.9
Private			0.7		0.7
Subtotal	92.6		2.3	5.2	100.1[a]
Maricopa County					
United States	56.4	*[b]			56.4
Arizona	6.9	3.0		0.1	10.0
Private	24.0	9.0	0.5	0.1	33.6
Subtotal	87.3	12.0	0.5	0.2	100.0
Pinal County					
United States	3.7				3.7
Arizona	45.6	2.0		0.3	47.9
Private	23.8	22.5	2.0	0.1	48.4
Subtotal	73.1	24.5	2.0	0.4	100.0
Pima County					
United States					
Arizona	86.5				86.5
Private	13.5				13.5
Subtotal	100.0				100.0
Cochise County					
United States	15.4	0.2		0.8	16.4
Arizona	54.5	1.5		0.2	56.2
Private	17.3	10.0		0.1	27.4
Subtotal	87.2	11.7		1.1	100.0
Total for counties traversed by right-of-way					
United States	35.1	*[b]		1.2	36.3
Arizona	31.8	1.7	0.3	0.2	33.9
Private	17.4	11.4	0.9	0.1	29.8
Total	84.3	13.1	1.2	1.5	100.0

[a] Due to rounding.
[b] * = Less than 1/10th of 1 percent.

Some neighboring farm areas are cultivated, but most are open-space areas. Adjacent to the Gila Compressor Station is another landing strip.

Pima County has the longest stretch of cultivated agricultural land along the pipeline, making up 24 percent of the total land crossed in the state (about 98 miles). In the middle of the county west of Casa Grande is the heaviest concentration of agricultural land use. Extending east of the Casa Grande Compressor Station, the land is a patchwork of open-space, multiple-use, grazing and agricultural lands with scattered pockets of urban uses. From the Florence Casa Grande Canal, open-space, multiple-use and grazing lands are the predominant use.

Pima and Cochise counties are generally open space, multiple use, and grazing except for scattered irrigated land along the San Pedro River just east of Redington. A 5-mile strip of agricultural land lies along the route north of Willcox and east of the Coronado National Forest.

Special features within the corridor and their proximity to the pipeline route are shown in Table 2.1.12.6-6.

Table 2.1.12.6-6

Special Features Within the Proposed Pipeline Corridor

Arizona

FEATURE	Proximity to the Proposed Pipeline Route (Approx. Miles)
Ehrenberg	.50
Gravel pits	.25
Colorado River	Traverses
Ehrenberg rest station	Adjacent
Kofa Game Range	Traverses

New Mexico

Percentage breakdowns of land uses by ownership are shown in Table 2.1.12.6-7 for New Mexico. Except for California, the greatest percentage of developed land is found in New Mexico, primarily in the Lordsburg and Deming areas. There is little agriculture; in fact, two small plots of ground outside of Lordsburg are the only classified agricultural land use along the pipeline in Hidalgo County. The pipeline runs south of the city limits and the airport. Of the total land along the pipeline in New Mexico, 81.3 percent is used as open space, multiple use, and grazing.

The two municipalities adjacent to the pipeline in Hidalgo County and Luna County are listed in Table 2.1.12.6-8 with approximate mileages and populations.

Table 2.1.12.6-7

Land Use Analysis Along Existing Pipeline, New Mexico
(As Percent of Totals)

OWNERSHIP	Land Use Classifications: Open Space Multi-Use Grazing	Cultivated Agriculture	Developed	Transp. Utility ROWs	Total
Hidalgo County					
United States	42.9				42.9
New Mexico	12.0			0.6	12.6
Private	26.4	11.1	5.2	0.3	43.0
Lordsburg				1.4	1.4
Subtotal	81.3	11.1	5.2	2.3	99.9[a]
Grant County					
United States	15.3				15.3
New Mexico	57.8				57.8
Private	26.9				26.9
Subtotal	100.0				100.0
Dona Ana County					
United States	58.8			0.5	59.3
New Mexico	22.2	0.3		0.4	22.9
Private	7.0	9.7	0.8	0.2	17.7
Subtotal	88.0	10.0	0.8	1.1	99.9[a]
Luna County					
United States	13.8				13.8
New Mexico	21.0			0.2	21.2
Private	36.3	19.1	9.5	0.1	65.0
Subtotal	71.1	19.1	9.5	0.3	100.0
Eddy County					
United States	70.9				70.9
New Mexico	19.4			0.1	19.5
Private	3.6	5.0	0.9	0.1	9.6
Subtotal	93.9	5.0	0.9	0.2	100.0
Lea County (to Jal No. 1)					
United States	81.6				81.6
New Mexico	5.8				5.8
Private	10.5		2.1		12.6
Subtotal	97.9		2.1		100.0

[a] Due to rounding.

Table 2.1.12.6-7 (Continued)

OWNERSHIP	Land Use Classifications Open Space Multi-Use Grazing	Cultivated Agriculture	Developed	Transp. Utility ROWs	Total
Total for counties traversed by right-of-way					
United States	46.2			0.1	46.3
New Mexico	20.8	0.1		0.2	21.1
Private	19.0	9.5	3.8	0.1	32.4
Lordsburg				0.2	0.2
Total	86.0	9.6	3.8	0.6	100.0

Table 2.1.12.6-8

Municipalities Adjacent to Pipeline Route, Hidalgo and Luna Counties

MUNICIPALITY	Approximate Miles Adjacent or Traversed	1970 Population
Lordsburg	1	3,429
Deming	1	8,343

In Grant County, all 19 miles along the pipeline are open-space, multiple-use, and grazing lands. The state owns over half of the lands which are interrupted only by two water sources: Jap Draw and Burro Cienega. Unlike its adjacent county, Luna County has 19 percent of its land along the route in agriculture. In the center of the county is the town of Deming, which is surrounded by irrigated cropland. East of the Deming Compressor Station, about 2 miles away, is a small airstrip. The Deming Municipal Airport is north of the pipeline in the southeastern edge of town. The first 36 miles of pipeline in Dona Ana County follow a route with strictly open space, multiple use and grazing. A 5-mile stretch along the Rio Grande bank is agricultural. About 10 miles east of the Rio Grande is the Texas-New Mexico

border. Grazing, multiple use, and open space form 86 percent of the land use along the pipeline route in New Mexico.

When the pipeline reenters New Mexico from Texas, the land use percentage reaches 93.9 percent for open space, multiple use and grazing. Southwest of Jal (in Lea County), the new pipeline would be installed to Midland.

Texas

In Texas, open space is mainly used for grazing and will be so labeled. El Paso Compressor Station lies just inside the El Paso County border. About 1 mile of cultivated land is crossed by the existing pipeline before traversing about 7 miles of Fort Bliss Military Reservation. On leaving the county, the pipeline swings past Hueco Tanks State Park into Hudspeth County. Except for the Cornudas Compressor Station and emergency aircraft landing strip 10 miles from Culberson County, the remainder of the land crossed is open range and comprises 99.6 percent of the total land crossed in Hudspeth County (58 percent of which is owned by the University of Texas).

About 5 miles into Culberson County the pipeline route skirts the southeastern edge of Guadalupe Mountains National Park. The terrain across the county is flat, open grazing land and is completely unbroken except for Compressor Station No. 1 about 13 miles from Eddy County, New Mexico. All of this land is privately owned and makes up nearly 98 percent of the land in Culberson County (Table 2.1.12.6-9).

The proposed new pipeline reenters Texas in Andrews County where 99.7 percent is open land. Adjacent Martin County is spotted with oil fields in an otherwise monotonous landscape of open range. However, nearing the terminal in Midland County, about 55 percent of the land is under cultivation, 36 percent is grazing land, with the remainder being developed and rights-of-way in the town as shown in Table 2.1.12.6-10.

Table 2.1.12.6-9

Land Use Analysis Along Existing Pipeline, Texas

(As Percent of Totals)

OWNERSHIP	Land Use Classifications: Open Space Multi-Use Grazing	Cultivated Agriculture	Developed	Transp. Utility ROWs	Total
El Paso County					
United States	18.9				18.9
Texas	13.3			0.7	14.0
Private	47.3	2.8	7.6	0.4	58.1
City of El Paso	9.0				9.0
Subtotal	88.5[a]	2.8	7.6	1.1	100.0
Hudspeth County					
United States					
Texas	1.6			0.1	1.7
Private	40.5				40.5
University of Texas	57.5		0.4		57.9
Subtotal	99.6		0.4	0.1	100.1[b]
Culberson County					
United States					
Texas					
Private	97.8		2.2		100.0
Subtotal	97.8		2.2		100.0
Total for counties traversed by right-of-way					
United States	3.7				3.7
Texas	3.3			0.2	3.5
Private	61.2	0.5	2.2	0.1	64.0
El Paso	1.8				1.8
University of Texas	26.8		0.2		27.0
Total	96.8	0.5	2.4	0.3	100.0

[a] Includes portions of McGregor Range used for military purposes.

[b] Due to rounding.

Table 2.1.12.6-10

Land Use Analysis Along Proposed Pipeline, Jal to Midland

(As Percent of Totals)

OWNERSHIP	Land Use Classifications				
	Open Space Multi-Use Grazing	Cultivated Agriculture	Developed	Transp. Utility ROWs	Total
State of New Mexico					
Lea County					
United States	41.9				41.9
Private	56.9			0.2	57.1
State				1.0	1.0
Subtotal	98.8			1.2	100.0
State of Texas					
Andrews County					
Private	99.8				99.8
State					0.2
Subtotal	99.8				100.0
Martin County					
Private	99.7				99.7
State				0.3	0.3
Subtotal	99.7			0.3	100.0
Midland County[a]					
Private	36.0	54.5	8.2	0.3	99.0
State				1.0	1.0
Subtotal	36.0	54.5	8.2	1.3	100.0
Total for counties traversed by right-of-way					
United States	5.4				5.4
Private	89.2	4.3	0.7	0.1	94.2
State				0.4	0.4
Total	94.6	4.3	0.7	0.5	100.0

[a] 310-acre terminal site located in Midland County.

2.1.12.7 Wilderness resources

This section will be limited to a discussion of wilderness resources and any existing wilderness areas that might be impacted by the proposed project including ancillary power lines. A complete definition of wilderness can be found in "The Wilderness Act of 1964." Refer to Section 2.1.10, Visual resources, which discusses the visual corridor of the proposed project including existing and proposed wilderness areas from which the project would be visible, as well as Section 2.1.12.3, Recreation resources, which discusses areas with primitive or natural values.

Existing designated wilderness areas

Exsiting designated wilderness areas within close proximity (15 miles) of the proposed project or its ancillary facilities are:

1. The San Gorgonio Wilderness Area in the San Bernardino National Forest in California.

2. The Galiuro Wilderness Area in the Coronado National Forest in Arizona.

3. The Franklin Mountains Wilderness Park in Texas. Although not Federal lands, the wilderness values of this city park have been recognized by El Paso in the park's official name.

Proposed wilderness areas

Areas for which wilderness values have been inventoried and public hearings held under provisions of the Wilderness Act are:

1. Joshua Tree National Monument. Major portions of this monument in California have been recommended to Congress for

wilderness designation.

2. Kofa Game Range. Major portions of this game range in Arizona have been recommended to Congress for wilderness designation.

3. Guadalupe Mountains National Park. Major portions of this park in Texas have been recommended to Congress for wilderness designation.

Potential wilderness areas

Areas having potential for wilderness include roadless areas and areas closed to recreational vehicles.

1. Mecca Hills. A portion of this California desert area has been closed to recreational vehicle use to protect scenic and natural values.

2. Orocopia Mountains. A portion of this California desert area has been closed to recreational vehicle use to protect scenic, natural and geologic values.

3. Desert lily. A portion of the California desert in Chuckwalla Valley north of Desert Center has been closed to recreational vehicles to protect the desert lily.

4. Eagletail Mountains. This desert mountain range in Arizona has been recommended by the Arizona Academy of Sciences (1974) for primitive or natural-area designation.

2.1.13 Use plans, controls, and constraints

2.1.13.1 Sea Leg and Port of Long Beach

Sea Leg

Except when within the inland waters of the United States, the "rules of the road" which will regulate the operation of the SOHIO vessels are set forth in the International Conference on Safety of Life At Sea, 1960, which has been ratified by the United States and is in force internationally. The Convention covers a broad range of subjects including construction machinery and equipment, fire protection, life saving appliances, the carriage of dangerous goods, and the like. In Annex B of the Convention are set forth Regulations for Prevention of Collision which have been enacted by Congress and are enforceable by the U.S. Coast Guard on the high seas and in territorial waters of the United States which are not inland waters (33 U.S.C para.1051 et seq.). These rules prescribe proper lighting, procedures for towing and pushing, speed in poor weather, steering and sailing rules, the meeting, crossing, and passing of other vessels, right-of-way, duties to avoid collision, sound signals, distress signals, and so forth.

The "rules of the road" applicable to the rivers, harbors, and inland waters of the United States, which would include the Valdez Arm and Prince William Sound as well as Long Beach Harbor, are set forth in Section 151 et seq. of Title 33 of the United States Code. These rules which are enforceable by the U.S. Coast Guard concern the lighting of vessels, sound signals in fog, speed in fog, the meeting, crossing and overtaking of vessels, right-of-way, lookout and other precautions, distress signals, and orders to helmsmen. In addition, Section 157 authorized the Commandant of the Coast Guard to promulgate such additional rules as he deems necessary for the safety of navigation on inland waters. Pursuant to this authority, the Pilot Rules for Inland Waters (33 CFR 80) have been adopted setting forth regulations

relating to signals, lighting, meeting, crossing and overtaking vessels, and the like.

In addition to the above rules which promote safe navigation, Section 391(a) of Title 46 of the United States Code empowers the Commandant of the Coast Guard to establish and enforce additional rules and regulations with respect to the design and construction, alteration or repair of all vessels in the domestic trade which have on board a cargo of oil, any inflammable or combustible liquid or any other substance designated as "hazardous" under the Federal Water Pollution Control Act (33 U.S.C para. 1151 et seq.). Such rules may include the design and construction of the superstructures, hulls, places for stowing cargo, fittings, equipment, appliances, propulsive machinery, and boilers, the handling and stowage of such cargo, and the manning of such vessels, including the duties and qualifications of the officers and crew.

Under the Ports and Waterways Safety Act of 1972 (P.L. 92-340) the Secretary of Transportation is further expressly authorized to promulgate rules and regulations for the purpose of protecting the marine environment by reducing the possibility of collision, grounding or other accident, reducing cargo loss following an accident and reducing damage to the environment by such normal vessel operations as deballasting, cargo handling, and the like. Pursuant to the above authority, the Coast Guard has adopted regulations respecting tank vessels engaged in the carriage of oil in domestic trade requiring new vessels of 70,000 DWT tons or more to have segregated ballast tanks and at least one slop tank (33 CFR 157).

With respect to regulations directed specifically at the prevention of marine pollution, the primary source of international law applicable to the proposed tanker route on the high seas is the 1954 Convention for the Prevention of Pollution of the Sea by Oil (TIAS 4900).

Alaska. That portion of the SOHIO tanker route which passes through Alaskan waters will be subject to the provisions of the Alaska Department of Environmental Conservation Act of 1971, as amended in 1972 and 1976 (A.S. 46, Chapter 03). Section 710 of this Act broadly proclaims that "no person may pollute or add to the pollution of the air, land, subsurface land or water of the state". Sections 740 and 750 are more specifically directed to the problem of oil pollution. Section 740 prohibits the discharge of oil or petroleum products into or upon the waters of the State except pursuant to a permit issued by the Department of Environmental Conservation or as permitted by Article IV of the 1954 Oil Pollution Convention. Section 750 prohibits any vessel from discharging into the waters of the State: ballast water, tank cleaning waste water or other waste containing petroleum in excess of 50 parts per million of oil residue. Any vessel which discharges such ballast water or other waste en route to a port in Alaska (apparently whether or not in Alaskan waters) may not take on petroleum or any other petroleum product as cargo when it arrives in such port.

State of Alaska legislation also requires tanker vessels in state waters to install specified electronic navigational aids such as Loran-C navigational system receivers, electronically controlled collision avoidance systems, and prescribed types of radar. Tankers over a certain size are also required to have specified maneuverability and stopping features or, as an alternative, such tankers must be escorted by tugs. Violation of this statute is a misdemeanor (A.S. 30, Chapter 20).

California. That portion of the SOHIO tanker route which passes through the jurisdiction of the State of California will be subject to the provisions of the Porter-Cologne Water Quality Act (Water Code para. 13000 et seq.). Section 13350 provides that any person who causes or permits any oil or any residuary product of petroleum to be deposited in or on any of the waters of the state, except in accordance with the requirements imposed by the appropriate regional Water Quality Control Board may be liable civilly in a sum not to exceed $6,000 for each day in which such deposit occurs. Section

13304(a) further provides that any person who intentionally or negligently causes or permits any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the State and creates or threatens to create, a condition of pollution or nuisance, as defined in the Act, must clean up such waste or abate the effects thereof.

Port of Long Beach

The Port of Long Beach is equipped with the necessary aids to navigation to mark the channels and entrance of the harbor. The U.S. Coast Guard requires that all oil spills be reported and cleaned up. Jacobsen Pilot Service, Incorporated, pilots vessels from Queens Gate to the appropriate berth. The pilot company monitors traffic in the harbor and has communications with vessels as required to ensure safe navigation. Deep draft vessels can anchor in an area southwest of Pier J while waiting to berth or while waiting for any other reason.

Future development of the Port of Long Beach is covered in the Port of Long Beach Master Plan; any apparent conflicts in policy between this Master Plan and the City of Long Beach General Plan, which also includes the Port, would be resolved in terms of the Master Plan superseding the General Plan. However, the Port of Long Beach Master Plan must be certified by the California Coastal Commission to be in accord with the California Coastal Act, before the Coastal Commission will relinquish its permitting authority over developments within the Port.

The California Coastal Plan promotes future port development only where development now exists and states a number of policy guidelines for such development.

2.1.13.2 Land

California

The currently planned land use along the pipeline corridor for the 1985 to 1990 time frame is described by county in the following section. Generally, the proposed land use follows the existing pattern of highly industrialized urban development throughout Los Angeles County. Open-space uses are the predominant land-use classification in Riverside and southwestern San Bernardino counties for the foreseeable future. The urbanization in those counties follows principally the Interstate 10 corridor southeasterly to Blythe. The existing urbanization is generally clustered around present population centers in this area.

Due to the diversity of the land-use plans, published by the three counties in the project area, a common classification system was developed to facilitate the presentation of data in a consistent manner. The categories represented on Maps 2.1.13-1 through 2.1.13-12 in Attachment 1 include Developed Land (Heavy Urban, Light Urban, Industrial) Agricultural Land and Open Space Lands.

The pipeline route through the three-county region traverses areas which are approximately 29 percent devoted to planned urban uses and 71 percent planned to nonurban uses. Despite the highly urban character of the pipeline corridor, the initial portion of the route through Los Angeles County is in a planned open-space area.

The central portion of the pipeline route through San Bernardino County may be characterized as urban, while the Riverside County section is generally nonurban in planned use. Planned land-use classifications and the percentages which the pipeline route traverses are: agriculture (5 percent), industrial (19 percent), residential (Heavy Urban) (4 percent), residential (Light Urban) (6 percent), and open space (66 percent).

Los Angeles County

Historic trends. During the early years in the history of the county the land was sparsely populated and urban settlements were small and widely spaced. The dominant economic activity at this time was livestock grazing. After the Civil War, the extension of the railroad and the introduction of commercial farming provided for a much denser population and for widespread development of towns and small cities. From World War I to the present, industrialization became the dominant characteristic. The automobile and the construction of a man-made harbor were two important factors in the industrialization, which in turn led to rapid urban expansion and high population density which is characteristic of the county today.

Agricultural. Fertile soil suitable for agricultural use is confined to the coastal lowlands of the Los Angeles Basin and to the Antelope Valley area north of the Angeles National Forest. Due to the extensive urbanization in the Los Angeles Basin, planned agricultural use is limited exclusively to the Antelope Valley (Los Angeles Regional Planning Commission, 1971). The pipeline route is not expected to traverse any areas that are currently identified as agricultural or are planned for agricultural use. (For expanded description see Section 2.1.12.4.)

Industrial. In Los Angeles County the pipeline corridor crosses extensively urbanized land, a large part of which is industrialized. The county endorses the importance of a regional land-use plan, as opposed to separate community plans, which would help coordinate separate land-use decisions. In the regional approach to land-use planning as reflected in the 1990 Land Use Policy Guide (Los Angeles Regional Planning Commission, 1971), special attention has been given to preserving the existing reserves of potential industrial land. Industrial use is included in the classification for Developed Land. Map 2.1.13-1, Attachment 1, illustrates the planned land use for Los Angeles County. Approximately 40 percent of the proposed

pipeline route in Los Angeles County traverses areas planned exclusively for industrial uses.

Residential. Rapid urbanization has been confined primarily to the coastal lowlands in the Los Angeles Basin. There are now over 1,100 square miles of developed land in south coastal Los Angeles County, nearly two-thirds of which is presently in residential use. Approximately 260 square miles of developable land remain, and are mostly in hilly areas such as the Puente Hills which is traversed by the pipeline route (Los Angeles County Regional Planning Commission, 1971). Planned residential use has been subdivided into two areas: single and duplex units and multifamily units. The single and duplex units (Light Urban) represent the vast majority of the area designated as Developed Land on Map 2.1.13-1, Attachment 1. Multifamily units, because of their higher density and value as a buffer zone for single and duplex unit residential areas, are separately discussed in the Los Angeles County Development Guide. The multifamily units are included in the Heavy Urban category.

The Heavy Urban designation also includes those population centers in the county which represent service areas and therefore have a highly diversified land usage. Approximately 4 percent of the pipeline route in Los Angeles County crosses areas planned for Heavy Urban uses.

Recreation and open space. Open-space land is any parcel or area of land or water which is essentially unimproved and devoted to an open-space use. Designation is on a local, regional, or state open-space plan for the preservation of natural resources, for the managed production of resources, for outdoor recreation, or for public health and safety (Los Angeles County Planning Commission, 1973).

A number of trends have led to an increased demand for more leisure activities: the population growth, the high degree of population mobility, the rise in family incomes, and the increase in leisure time or time spent

not working. A great proportion of leisure time is spent in various activities carried on away from home. Recreation accounts for much of this time.

The desire for outdoor activity and undisturbed natural beauty is strong and is creating a rising demand for open space and recreation facilities (Los Angeles County Regional Planning Commission, 1971).

The major open-space goal of the county in meeting these demands is to create, protect and preserve a countywide open-space system which serves the needs of all segments of the county population.

Linear features such as flood control channels, highways, railroad and public utility rights-of-way present opportunities for hiking, bicycling, horseback riding, and use for other recreational vehicles. While most of the major existing riding and hiking trails are located in the Angeles National Forest, the Los Angeles County Department of Parks and Recreation maintains approximately 50 miles of equestrian trails and some 22 miles of bikeway along major operating flood control channels. The operating flood control rights-of-way, spreading grounds and utility rights-of-way adjacent to the flood control channels create opportunities for further recreational use within their corridors.

A recent proposal for utilizing these open areas is the Rio Hondo-Los Angeles River beautification project (Map 2.1.12-C, Attachment 1). It involves 1,000 acres of publicly owned and utility-owned property extending from the Whittier Narrows Dam southeasterly to the vicinity of the city of Lynwood.

Another proposal is the southeast Los Angeles-Orange County project involving portions of the San Gabriel River and Coyote Creek.

Three other major proposals currently being given some consideration include trails located along the Santa Clara River, the Los Angeles River, and the coastal area. The relationship of the pipeline route to the planned open space areas in the county is shown on Map 2.1.13-1, Attachment 1. More than half of the proposed pipeline route (approximately 56 percent) is located in areas planned for open-space uses.

San Bernardino County

Historic trends. The southwestern part of San Bernardino County has been devoted primarily to agricultural uses involving dairies, poultry, grazing and field crops. As population pressures in the Los Angeles area increased, this valley portion of the county became more urbanized, approaching the San Bernardino city area density. This urban development spread along the transportation corridors, principally where Interstate 10 is now.

In 1964, the valley portion of the county, bounded on the north by the San Bernardino National Forest, was approximately 23 percent agricultural, 20 percent urban, 35 percent vacant, and 22 percent undevelopable land (San Bernardino County Planning Department, 1966b). As the following sections indicate, this area of San Bernardino County is presently planned for intensive urban development and substantial open space, with very little agricultural use remaining.

Agricultural. The extent of planned agricultural-use land is shown on Map 2.1.13-2 in Attachment 1. Although the amount of land in agricultural use has been severely reduced as a result of urban encroachment, these areas likely will remain in productive agricultural use for sometime (San Bernardino County Planning Department, 1966a). Of the proposed pipeline route in San Bernardino County, approximately 11 percent crosses areas designated for agricultural use.

Industrial. The planned Developed Land for industrial use (Map 2.1.13-2, Attachment 1) has been concentrated in central core complexes with good transportation access, close to the labor force. It is anticipated that all types of industrial uses will locate in these areas (San Bernardino County Planning Department, 1966a).

Planned industrial-use areas constitute approximately 47 percent of the pipeline route in San Bernardino County.

The Developed Land category of land use is essentially industrial/commercial (Heavy Urban) in San Bernardino County. The designation includes the Urban Core areas, the administrative and commercial centers of the urbanized region, and the Urban Services areas, primarily the light industry necessary to provide the specialties and satisfy the internal service needs of the urban community (San Bernardino County Planning Department, 1966a).

Approximately 29 percent of the pipeline corridor traverses areas planned for Heavy Urban use in San Bernardino County.

Residential. The Developed Land designation on Map 2.1.13-2, Attachment 1, illustrates the areas planned primarily for residential development (Light Urban). Also included in this category are the less intensive institutional and commercial uses (schools and neighborhood shopping areas).

Approximately 13 percent of the pipeline route crosses areas planned for Light Urban uses.

Recreation and open space. Planned open-space land includes areas of watershed, water conservation, forest reserves, and mountainous terrain. This category of planned use is designed to buffer incompatible land uses and to retain land areas in their primary uses (flood control, water conservation, etc.) by preventing their development. Regional park areas are interspersed within the open-space system, shown on Map 2.1.13-2, Attachment 1.

Riverside County

Historic trends. Riverside County was formed in 1893 from parts of San Bernardino and San Diego counties. Its 7,300 square miles make it the fourth largest county in California. The county has historically been sparsely populated, however, and has a 1970 density of 64 persons per square mile. Its predominantly arid climate has thus far preserved the county from the rapid urbanization which San Bernardino and Los Angeles have experienced. The land use in Riverside County is predominantly in open space/recreational and agricultural. This dominance is likely to remain, as illustrated by Maps 2.1.13-2 through 2.1.13-5 in Attachment 1. However, urbanized areas are projected to increase by approximately 43 percent in the next 15 years, based on population projections (Urban Economics Research Associates, 1972).

Agricultural. The Riverside County General Plan does not include forestry in the planned land-use categories cited (Riverside County Planning Commission, 1966). The forested areas of the county are in use as recreational and open-space areas rather than timber production and are included in the Open Space category.

The planned agricultural-use lands, which the proposed pipeline route traverses, are confined to the Indio-Coachella area in the center of the county and to the Blythe area on the Colorado River (Maps 2.1.13-3 and 2.1.13-5, Attachment 1). These "Agricultural Reserves" (Riverside County Planning Commission 1966) represent areas of the best soils with a minimal amount of urban encroachment.

Approximately 6 percent of the proposed pipeline route traverses areas which are planned for agricultural use.

Industrial. Areas of Riverside County which are planned for industrial use are included in the Developed Land category on Maps 2.1.13-2 through 2.1.13-

5, Attachment 1. The areas designated Developed Land include Heavy Urban and some industrial use lands which are compatible with other urban uses. Much of the planned industrial use land is presently agricultural. There is probably more area planned for industrial use than will be necessary in the next 10 years. These areas are well suited to industry, however, and will remain reserved for that use indefinitely (Riverside County Planning Commission, 1966).

Residential. Planned residential areas in Riverside County are included in the Developed Land category (Heavy Urban and Light Urban), shown on Maps 2.1.13-2 through 2.1.13-5, Attachment 1. The proposed pipeline route in Riverside County traverses approximately 10 percent percent of land planned for Light and Heavy urban uses. The Developed Land areas are planned for an average density of between 2,500 and 5,000 persons per square mile. Within the designated Developed Land areas, the amenities necessary for day-to-day activities will be located: commercial, institutional, industrial, and residential (Riverside County Planning Commission, 1966).

Recreation and open space. Planned open-space lands comprise approximately 84 percent of the area traversed by the proposed pipeline route in Riverside County (Maps 2.1.13-2 through 2.1.13-5, Attachment 1). This category includes primarily mountainous areas which have been precluded from planned development because of the importance of this terrain in water conservation and the high incidence of brush fire, as well as obvious topographical constraints. The desert areas may be subject to periodic inundation of water, but have no known dependable water supply, and are not practical for planned development with present technologies.

The Riverside County General Plan did not address planned recreation areas as such. There are numerous existing recreational areas administered by Federal, state, and local agencies (see Section 2.1.12.3); however, proposals to expand these areas are not mentioned. Open-space land of Riverside County provides the opportunity for unlimited recreational

activity, an activity which is to increase as the population of southern California continues to grow.

Arizona

Historic trends. The earliest Spanish settlements in Arizona were established as presidios and missions. During the early years of occupation and settlement, under Spanish, Mexican, and United States rule, some small amounts of farming and grazing took place in the vicinity of the established communities. During the early 1900s, a considerable amount of land was converted to irrigated cropland as deep-well technology was introduced and irrigation systems developed. Irrigated croplands are used to raise citrus fruits, cotton, vegetables, and other high value crops. However, the largest percentage of land is devoted to open range or grazing land. At present, 71.65 percent of all land in Arizona is Federally owned or trust lands, 13.2 percent is state-owned land, and 15.15 percent is privately owned land.

Agriculture. Open Space (grazing land or open range) is the predominant form of land use reserve in each of the Arizona counties traversed by the pipeline as shown in Maps 2.1.13-6 through 2.1.13-9, Attachment 1. Some cultivated land is traversed in western and southern Maricopa County. With the exception of a small amount of irrigated cropland in Cochise County, the pipeline traverses grazing land in the other counties. The grazing lands are extensive and will likely remain as grazing lands in Yuma, Pima, and Cochise counties. However, urbanization in Maricopa and Pinal counties is encroaching on both grazing and cultivated land uses as population grows and land prices increase. Land-use planning information was available only from Maricopa and Pinal counties.

Industrial. There is no evidence of industrial land-use planning along the pipeline corridor in Arizona.

Residential. Future residential land uses are most apt to occur in the Developed Land noted in Maricopa, Pinal, and Cochise counties in Arizona. The pipeline route in Yuma and Pima counties does not encounter potential residential development areas. The pipeline route is relatively isolated from residential areas except in Pinal County in the vicinity of Stanfield, Casa Grande, and Coolidge and in Cochise County near Willcox and Bowie.

Recreation and open space. In Yuma County, the pipeline route would cross the Kofa Game Range which is a dedicated recreation and open-space reserve. The pipeline crosses the Gila River south of Arlington in Maricopa County. The Gila River bottomland is designated as a Greenbelt Resource Conservation Area which is being managed as a wildlife reserve and hiking and camping area. The point where the pipeline crosses the Gila River is one of the narrowest points of the greenbelt area.

New Mexico

Historic trends. Agriculture, primarily grazing and crop production, and mining form the basis for early settlement patterns in the southern New Mexico counties traversed by the proposed oil transportation system. Early settlers in southwestern New Mexico were continually harassed by Indian raids, and maintained a tenuous hold on their land. It was not until the late 1800s and early 1900s that permanent settlements were established, and ranching and farming became established land uses. Mining was important near Lordsburg in Hidalgo County and in northern Grant County near Silver City.

Spanish colonial period. Today, agricultural crops of the Mesilla Valley still provide an important economic factor in Dona Ana County. Eddy and Lea counties are noted for their excellent grazing land. In more recent years, dating from the mid-1920s, much of the area has been devoted to gas and oil production from the Permian Basin. While production is dwindling, it is expected that oil and gas production will remain important for many years.

Grazing will continue to be a principal land use for the foreseeable future as illustrated on Maps 2.1.13-9 and 2.1.13-10, Attachment 1.

Agriculture. Irrigated agricultural lands are encountered along the pipeline route in Hidalgo, Luna, Dona Ana, and Eddy counties. Luna County shows expansion south of Deming in cultivated land for future land use. Such growth in agricultural production around towns can be expected for scattered population centers. The most extensive crop production occurs in the Mesilla Valley in Dona Ana County. Cotton and truck farming will continue to occupy the irrigated land in the Mesilla Valley area. Irrigated lands in the other counties are devoted, for the most part, to feed crops associated with cattle raising. The bulk of the agricultural land in all six New Mexico counties traversed by the pipeline is devoted to open range, or grazing, and will continue to be utilized in this manner for the foreseeable future.

Industrial. Aside from highway, road, pipeline and railroad crossings, no planned industrial land-use areas are encountered in New Mexico.

Residential. The pipeline route traverses planned residential land-use areas south of Lordsburg and Deming in Hidalgo and Luna counties, respectively. Aside from these two communities, no other areas along the pipeline route are planned residential land-use areas.

Recreation and open space. No planned recreation or open-space areas are traversed by the Long Beach to Midland pipeline route in New Mexico.

Texas

Historical trends. Cattle ranching has been the traditional land use in nearly all of the area traversed by the proposed oil transportation pipeline route in Texas.

The small amount of irrigated farming that is done is devoted to growing cattle feed crops. The early settlement patterns around El Paso found farms stretching north and southeasterly along the Rio Grande bottomlands. The "mesas" or uplands have traditionally been used for cattle and sheep grazing. These land use patterns outside of the El Paso urbanized area are likely to continue for sometime into the future. Oil and gas production facilities form a secondary land use in the area between the New Mexico-Texas border and Midland.

Land-use planning has been accomplished in Culberson, Hudspeth, Andrew, Martin, and Midland counties and is shown on Maps 2.1.13-11 and 2.1.13-12, Attachment 1.

Agriculture. With the exception of a very small amount of irrigated cropland north of El Paso and north and east of Midland, the entire pipeline route traverses Open Space (open range or grazing land) use areas. Future land use plans in this area allow for little change in the open range land. The area around Midland is planned for development usage, but it can be assumed small-scale truck farming will also be present.

Industrial. The proposed oil transportation pipeline does traverse a planned industrial park at the northern El Paso city limits in El Paso County. The land-use planning pattern does include a pipeline corridor. The new pipeline would cut across existing oil and gas reserves in the final stretch to the new Midland terminal. The Midland terminal site is located in an area zoned and reserved for tank farms.

Residential. The future land-use plan for El Paso County is not complete at this writing. However, no area proposed for residential use is proposed to be traversed in the county. The route skirts two land subdivisions near Hueco Tanks State Park in El Paso County.

Recreation and open space. No area planned for recreation or designated for open space uses is traversed by the pipeline in Texas.

2.1.14 Transportation networks

2.1.14.1 Marine

It is necessary to represent marine traffic statistically because it is extremely difficult to define exactly the number and routes of all vessels plying the seas between Valdez and Long Beach. The proposed route passes by many Pacific Ocean ports, and the way to estimate the number of ships at sea is to use traffic counts collected at locations where the ships must pass when departing for or arriving from a sea voyage. Table 2.1.14.1-1 lists the total number of commercial ship transits at seven Pacific Coast locations. Some of this traffic will intersect the SOHIO tanker route, and some will parallel it.

In Table 2.1.14.1-1, the total vessel traffic (TVT) includes cargo, tanker, passenger, tug, and barge vessels. Although there is a rather large trade in commercial barge traffic along the West Coast, a great majority of this traffic travels coastwise close to shore or within internal waterways such as Puget Sound. For this reason the total tanker, cargo, and passenger vessel transits (TTCP) shown in Table 2.1.14.1-1 are a better estimate of the commercial traffic that may intersect the SOHIO route. For the Panama Canal only the total vessel transits (TVT) are available.

Table 2.1.14.1-2 shows commercial coastwise vessel movements for the West Coast of North America for 1975. Los Angeles/Long Beach led in departures, San Francisco was next, followed by the Pacific Northwest, the west coast of Canada, and the Panama Canal.

The general pattern of SOHIO vessel traffic coincides with shipping routes where the cargo ships may reach a maximum range of 40,000 DWT and tankers

Table 2.1.14.1-1

Pacific Ocean Marine Traffic Statistics

PORT OR WATERWAY	Traffic Type[a]	Total Traffic by Year[b] 1970	1971	1972	1973	1974	1975
Panama Canal[c]	TVT	13,658	14,020	13,766	13,841	14,033	13,609
	TTCP	NA	NA	NA	NA	NA	NA
	TCT	127.94	132.87	122.34	141.23	165.66	156.91
San Diego	TVT	4,069	3,640	3,550	3,643	3,301	NA
	TTCP	3,042	3,131	2,944	2,873	2,499	NA
	TCT	2.07	1.81	1.67	2.06	2.12	NA
Los Angeles/[d]	TVT	33,591	27,811	NA	NA	33,617	NA
Long Beach	TTCP	11,898	10,210	9,328[d]	11,693[d]	9,941	NA
	TCT	44.87	44.19	44.64	53.13	52.81	NA
Oxnard/ Port Hueneme	TVT	NA	513	724	1,891	1,241	NA
	TTCP	NA	442	623	1,792	975	NA
	TCT	NA	0.16	1.17	1.11	0.98	NA
San Francisco Bay entrance	TVT	11,038	8,952	9,250	9,366	8,455	NA
	TTCP	10,317	8,197	8,439	8,608	7,539	NA
	TCT	39.65	40.37	44.56	48.58	44.21	NA
Columbia River entrance	TVT	6,621	5,702	5,903	6,085	4,989	NA
	TTCP	4,993	3,829	4,516	4,881	3,815	NA
	TCT	19.54	16.75	20.28	23.59	22.62	NA
Valdez	TVT	644	856	375	597	1,611	NA
	TTCP	540	610	334	521	805	NA
	TCT	0.48	0.29	0.25	0.30	0.36	NA

Source: Tetra Tech, Incorporated, 1977.

[a] Key: TVT = Total vessel transits for all type vessels.
TTCP = Total tanker, cargo and passenger vessel transits.
TCT = Total cargo tonnage (millions of short tons).

[b] Based on Waterborne Commerce Statistics (U.S. Army Corps of Engrs., 1974) unless otherwise noted.

[c] Based on Annual Report, FY 1975, Panama Canal Company. These data are for fiscal years ending 30 June of year shown. However, the annual traffic is evenly distributed by month.

[d] Waterborne Commerce Statistics (U.S. Army Corps of Engrs., 1974) corrected by check with Los Angeles Harbor Department.

Table 2.1.14.1-2

1975 Commercial Coastwise Vessel Movements in Northeastern Pacific Ocean

Departing from: \ Arriving at:	Panama Canal (b)	San Diego	Los Angeles Long Beach	El Segundo (c)	Oxnard-Port (c) Hueneme	San Francisco	US Pacific Northwest	West Coast (b) Canada	Valdez
Panama Canal (b)		114	454	0	0	115	114	142	0
San Diego	97		129	0	0	34	58	—[d]	0
Los Angeles Long Beach	454	127		0	0	1563	409	—	30
El Segundo (c)	0	0	0		269	0	0	0	0
Oxnard-Port (c) Hueneme	0	0	0	269		219	0	0	0
San Francisco	161	22	961	0	219		430	—	83
US Pacific Northwest	97	82	481	0	0	448		x[e]	•
West Coast (b) Canada	947	—[d]	—	0	0	—	x		x
Valdez	14	0	28	0	0	58	x	x	

(a) Data from unpublished report by US Coast Guard, unless otherwise stated.

(b) Data compiled from a combined consideration of unpublished US Coast Guard reports, Los Angeles Harbor Department Statistics, and Panama Canal Statistics.

(c) Data from Corps of Eng., 1974 Waterburne Commerce Statistics and Oxnard Harbor District.

(d) NO data.

(e) X means traffic outside the SOHIO route.

may reach a maximum tonnage of 80,000 DWT. In Alaskan waters, the 1975 annual count indicated that 430 vessels visited the Valdez area. In the Santa Barbara Channel, the 1975 count was as high as 4,000 vessels in the vicinity of Port Hueneme and as high as 7,700 offshore of Point Fermin.

Table 2.1.14.1-3 presents information on 1975 vessel transits that would intersect the SOHIO route. Los Angeles/Long Beach has 40 percent more transits than San Francisco.

Tables 2.1.14.1-4 and 2.1.14.1-5 relate data on the distribution of vessels by type along the West Coast. Waterborne Commerce Statistics (U.S. Army Corps of Engrs., 1974) classifies vessels by draft into five groups: (1) passenger and dry cargo vessels, (2) tankers, (3) towboats or tugboats, (4) dry cargo barges, and (5) tanker barges. Table 2.1.14.1-4 reflects 20 vessel types by their characteristics. Table 2.1.14.1-5 contains probability density histograms for the seven Pacific ports. These histograms are presented in terms of the total vessel transits recorded at a port or waterway in 1974 (Waterborne Commerce Statistics, U.S. Army Corps of Engrs., 1974). Only vessels in the cargo or tanker classes were considered in deriving the distributions because it was assumed that only vessels of this size and type would intersect the SOHIO route.

Table 2.1.14.1-3

Total 1975 Vessel Transits on Overseas Routes

Intersecting the SOHIO Tanker Route

PORT OR WATERWAY	Total Vessel Transits
Straits of Juan de Fuca[a]	2,624
Columbia River entrance	2,368
San Francisco Bay entrance[b]	3,666
Los Angeles-Long Beach	5,305

Source: Tetra Tech, Inc., 1977.

[a] Computed using the assumption that the ratio of coastwise to foreign vessel transits is the same as at the Columbia River entrance.

[b] Value adjusted to agree with Marine Exchange data.

Table 2.1.14.1-4

Vessel Types and Characteristics[a]

VESSEL TYPE DESIGNATION	Vessel Type	Draft Range (ft)	Displacement Range (1,000 tons)	Length Range (ft)	Breadth Range (ft)
A	Cargo	11.0-14.5	1 - 5	111.2-170.2	28.3-33.2
B	Cargo	14.5-24.5	5 - 10	170.2-381.8	33.2-52.7
C	Cargo	24.5-30.5	10 - 20	381.8-534.9	52.7-69.4
D	Cargo	30.5-34.0	20 - 30	534.9-632.3	69.4-81.6
E	Cargo	>34	30 - 40	>623.3	>8.16
F	Tanker	10.0-20.5	1 - 5	112.5-319.4	31.2-47.0
G	Tanker	20.5-24.5	5 - 10	319.4-398.2	47.0-55.0
H	Tanker	24.5-29.5	10 - 20	398.2-496.7	55.0-66.9
I	Tanker	29.5-32.5	20 - 30	496.7-555.8	66.9-75.2
J	Tanker	32.5-35.0	30 - 40	555.8-605.0	75.2-83.0
K	Tanker	35.0-36.7	40 - 50	605.0-638.5	83.0-88.7
L	Tanker	36.7-38.0	50 - 60	638.5-664.1	88.7-93.3
M	Tanker	38.0-39.2	60 - 70	664.1-687.7	93.3-97.8
N	Tanker	39.2-40.2	70 - 80	687.7-707.4	97.8-101.7
O	Tanker	>40.2	>80	>707.4	>101.7
P	Tug	>17.5	1 - 5	>139.3	>35.0
Q	Dry Cargo Barge	7.0-13.0	1 - 5	129.3-240.7	40.6-60.3
R	Dry Cargo Barge	>13.0	5 - 10	>240.7	>60.3
S	Tank Barge	7.5-15.0	1 - 5	132.0-248.2	37.3-56.4
T	Tank Barge	>15.0	5 - 10	>248.2	>56.4

Source: Tetra Tech, Inc., 1977.

[a] Part of this table was obtained by using functions presented by Science Applications, Inc., 1975, LNG Terminal Risk Assessment Study for Oxnard, California.

Table 2.1.14.1-5

Vessel Type Probability Density Histograms[a]

PORT OF ORIGIN[b] VESSEL TYPE DESIGNATION	Panama Canal[c]	San Diego	Los Angeles/ Long Beach	Port Hueneme/ El Segundo	San Francisco Bay -- Entrance Ports	U.S. Pacific Northwest and Western Canadian Ports[d]	Valdez
A	0.002	0	0	0	0	0	0.604
B	0.377	0.890	0.376	0.869	0.260	0.439	0.153
C	0.276	0.054	0.275	0.019	0.337	0.264	0.003
D	0.088	0.016	0.086	0.004	0.094	0.115	0.014
E	0.019	0.001	0.017	0.003	0.012	0.039	0
F	0.049	0.014	0.047	0.014	0.040	0.024	0.153
G	0.029	0.006	0.027	0.004	0.039	0.030	0.005
H	0.050	0.009	0.048	0.012	0.066	0.028	0.037
I	0.053	0.008	0.051	0.067	0.089	0.036	0.025
J	0.035	0.001	0.033	0.006	0.037	0.020	0.006
K	0.012	0	0.010	0.001	0.008	0.005	0
L	0.010	0	0.009	0	0.005	0.001	0
M	0	0	0.003	0	0.002	0	0
N	0	0	0.002	0	0.001	0	0
O	0	0	0.016	0	0.010	0	0
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Tetra Tech Inc., 1977.

[a] Derived from Waterborne Commerce Statistics (U.S. Army Corps of Engrs., 1974).

[b] See Table 2.1.14.1-4, Vessel Characteristics.

[c] Panama Canal traffic is assumed to be distributed according to the Los Angeles-Long Beach traffic description, except for a correction factor to account for a draft limitation of 38 feet.

[d] Based on vessel transits through the mouth of the Columbia River.

2.1.14.2 Port of Long Beach and terminal area

Vessel traffic

The following information has been extracted from the Draft Environmental Impact Report, Proposed General Plan, 1975, Port of Long Beach, Volume 1, Appendix C.

> Current vessel traffic in and out of the Port of Long Beach is approximately 6,700 vessel movements per year. It is estimated that peak daily traffic would be 30 vessel movements. The southeast basin of the Port accommodates about 35 percent of the total water traffic, the east basin 20 percent, the back channel and inner harbor 28 percent, the west basin nine percent, and the remaining eight percent anchored outside the Port docking areas.
>
> The combined Ports of Long Beach and Los Angeles have a low vessel casualty rate compared to United States harbors in general. In the three-year period between January 1972 and December 1975, the United States Coast Guard recorded 14 vessel collisions in and near the Los Angeles/Long Beach Port. There were no injuries or fatalities involved in any of these accidents. Minor vessel damage ($2,000 or less) resulted from three accidents; moderate vessel damage ($10-20,000) from two accidents; and one collision resulted in severe vessel damage ($950,000). The types of collisions involved were as follows: groundings with no damage, 5; groundings with damage, 3; collisions with an anchored vessel, 2; collisions with a crossing vessel, 1; collisions with a vessel while docking, 2; and collisions with a vessel in an overtaking situation, 1. Five of the accidents occurred during daylight hours, seven at night, and two during twilight periods. It should be noted with regards to the above, that there have been no reported vessel collisions within the limits of the Port of Long Beach in at least the last 10 years.
>
> A study made by the Marine Inspection Office (LA-LB), United States Coast Guard, in 1972, concerning a proposed Vessel Traffic System (VTS) included casualty data on collisions with other vessels, fixed objects, and groundings that theoretically may have been prevented if a VTS were in operation. The accident data summary covered the period between January 1967 and September 1972 when nine potentially preventable collisions occurred. The proposed VTS would encompass: development and promulgation of traffic management regulations, incorporating applicable parts of existing Port Tariffs; use of the existing traffic separation scheme and the planned addition to the sea lane system; vessel movement reporting for an area approximately 20 miles northwest of the breakwater area (Precautionary Area) to 20 miles southeast of this area, twelve miles off shore; and radar surveillance of the area requiring movement reporting. The installation of a VTS at the Los Angeles/Long Beach Port has been approved, but, due primarily to the low vessel casualty rate and existing high-efficiency operational system at this Port compared to other United States Ports in general, it is estimated that the monitoring system will not be operational until 1990. This priority could change if increases in water traffic warrant it.

The combined Los Angeles/Long Beach coastal area has berths for approximately 6,000 small craft; about 3,100 berths in the Port of Los Angeles, 200 berths in the Port of Long Beach, and 2,700 in the Long Beach Marina. These crafts plus visitor crafts account for an estimated 178,500 boat-days of use per year. Small craft movements for the combined Port area have been estimated as 1,700 movements per day on a typical weekend day and 2,500 movements per day on a peak weekend day. About one-half of these movements (which include visitor as well as berthed craft) would probably remain inside the harbor breakwaters.

It should be noted that based on past casualty data, the Los Angeles-Long Beach Harbors were listed twentieth in order of need for a Vessel Traffic System on a priority list of 22 U.S. ports. At this time, no projected date of operation has been established.

Pipeline network

The pipeline network in the Long Beach, Los Angeles, and Orange counties area is best described as an underground spider web. There are many crude oil gathering and transportation lines, many condensate lines, and many refined-product lines with myriad interconnections to permit inter-company and inter-area transfers, sales, and exchanges. Crude oil pipelines, their estimated capacity, and their current throughput in the Long Beach/Los Angeles area are presented as accurately as possible in Tables 2.1.14.2-1, -2, -3, and -4 and in Figure 2.1.14.2-1. All major refineries utilize their own refined-product pipelines to product terminals located in the inner harbors of Long Beach and Los Angeles. Most have surge tanks located at these product terminals which minimize the size of product lines. All major refineries utilize at least one light oil system and one dark oil system to avoid contamination of products delivered to ships. Some major refineries use their own product-pipeline networks to deliver refined products to remote satellite truck terminals located in areas more central to the Los Angeles marketing area. Shell Oil utilizes pipelines of 4-, 6-, and 8-inch diameters to deliver products from the refinery to the Ventura and Santa Monica areas (The Oil and Gas Journal, 1973).

Table 2.1.14.2-1

Main Landside Transportation; Pipelines Entering Long Beach/Los Angeles

COMPANY	Size Inches	From	Destination	Estimated Capacity [a] bpd	Throughput bpcd
Four Corners Pipe-line Company	16	Four Corners (From east)	Gulf refinery (12") Mobil refinery (16") Standard refinery (16") Shell refinery (16") Union Torrance tank terminal (16")	137,800	28,000
Shell Oil	10	Ventura area (From N.W.)	Standard refinery Shell refinery	61,000	
Union Oil	12	Torrey area (N.W.) & Los Angeles city production	Union refinery Standard refinery Mobil refinery	85,500	
Mobile Oil	2-8	Kern County area (Midway Field)	Mobil refinery Shell refinery Texaco refinery	76,500	
Atlantic-Richfield	14	Kern County Cuyama area Ventura area	Arco refinery Texaco refinery	103,000	

Source:

[a] Estimated at a velocity of 7.11 feet/second at pumping temperature of about 100°F and 100 percent utilization.

Table 2.1.14.2-2

Main Crude Pipelines From Deepwater Terminals in Long Beach/Los Angeles Areas

COMPANY	Size Inches	From	Destination	Estimated Capacity bbl/d [a]	Throughput bbl/cd	Comments
Union Oil	30	Port of Los Angeles Berths 45, 46, 47	Surge tankage San Pedro	720,000		Peak rate about 1,750,000 bbl/d depending on ship's pumps and surge tank outage.
	12	San Pedro	Union refinery Union Torrance Tank terminal	85,500		
Mobil Oil	36	Port of Los Angeles Berths 45,46,47	Terminal Island tankage	1,000,000		Peak rate about 1,500,000 depending on ship's pumps and surge tank outage.
	24	Terminal Island tankage	Mobil refinery	312,500		
Arco	24	Port of Long Beach	Surge tankage at Port of Long Beach	450,000		
	12	Surge tankage	Arco refinery	85,500		

[a] Based upon a velocity of 7.11 feet/second in transportation lines and about 10 feet/second in ship unloading lines.

Table 2.1.14.2-3

Crude Supply Pipelines From Offshore Mooring in the Los Angeles/Long Beach Areas

COMPANY	Size Inches	From	Destination	Estimated Capacity bbl/d	Throughput bbl/cd	Comments
Standard Oil	Unknown Several Lines	Offshore El Segundo	Standard Refinery	Unknown		At least two 30-inch pipelines
Gulf Oil	24	Offshore Huntington Beach	Surge Tankage in Huntington Beach	450,000		
	12	Surge Tankage	Gulf Refinery in Santa Fe Springs	85,500		

Table 2.1.14.2-4

Main Crude Transportation Lines From Producing Areas in

Eastern Los Angeles County and Orange County

COMPANY	Size Inches	From	Destination	Estimated Capacity bbl/d	Throughput bbl/cd	Comments
Standard Oil	8/10/12	Placentia Brea Brea Olinda Whittier Huntington Beach Long Beach	Standard Refinery	38,300		
Union Oil	10	Richfield Field Brea Brea Olinda Placentia Santa Fe Springs	Union Refinery	61,100		
	8	Seal Beach Thums Wilmington	Union Refinery Champlin Refinery	38,300		Splits to two 8" lines.
Arco	8/10	Seal Beach Wilmington Huntington Beach	Arco Refinery	38,300		
Mobil	8	Wilmington	Mobil Refinery	38,300		
Texaco	8	Richfield Field Huntington Beach Long Beach	Texaco Refinery	38,300		Splits to two 8" lines.
Shell	8	Brea La Habra	Shell Refinery	38,300		

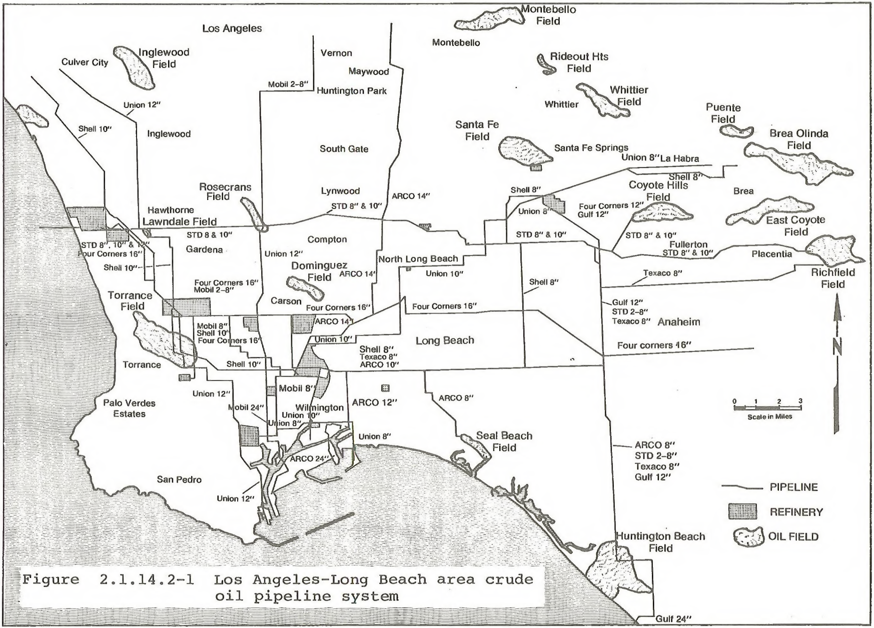


Figure 2.1.14.2-1 Los Angeles-Long Beach area crude oil pipeline system

Street system

The arterial street system in and adjacent to the Port of Long Beach is shown on Figure 1.1.1.2-1. The Port of Long Beach is also served by a railway network.

Regional access to the Port of Long Beach is provided by the Harbor Freeway, the Terminal Island Freeway, and the Long Beach Freeway via Harbor Scenic Drive. The primary surface street access is via Ocean Boulevard-Seaside Avenue, an east-west arterial across the combined Los Angeles-Long Beach Port area. Additional access is provided by way of Henry Ford Avenue, Pico Avenue, and the Queens Way Bridge.

Area-wide access to the Pier J project area would normally be via Shoreline Drive and Ocean Boulevard to and from the east; Harbor Scenic Drive and the Long Beach Freeway (California 7) to and from the north; and Ocean Boulevard and Seaside Avenue to and from the west. Final access to the project site would be by way of Harbor Scenic Drive.

In August, 1975, Crommelin-Pringle & Associates, Inc. (CP&A) made a capacity and volume study of arterials in the vicinity of the project site (Port of Long Beach and California Public Utilities Commission, 1976). All three freeways that serve the Port area are operating at relatively high levels of service. As a result, the north-south surface street system is operating at a very high level of service. Many portions of the east-west street system are operating at, or in excess of, design capacity both east and west of the project area. Ocean Boulevard west of the study area is now operating approximately 20 to 25 percent above its design capacity during peak weekday periods. Pico Avenue on the north portion of Long Beach Harbor is 13 percent in excess of its capacity northbound during the afternoon peak hour and at capacity southbound during the morning peak-hour period.

The August, 1975 study included surveillance activities to obtain additional peak-hour operational information. No serious congestion was observed at any location south of Ocean Boulevard. Minor delays occur in the afternoon peak period at the intersection of Panorama Drive and Harbor Scenic Drive, which is controlled by stop signs. At that location, Harbor Scenic Drive carries an average daily volume of 7,000 vehicles with peak-hour volumes of approximately 750 vehicles in the direction of heaviest flow, according to the study by Crommelin-Pringle and Associates, Inc.

On the basis of numerous truck classification counts made by Port of Long Beach personnel in recent years, it is estimated that trucks comprise 7.5 percent of the total traffic flow during peak commuter periods. Although data were not available for off-peak periods, truck traffic would constitute a much higher percent of the total, probably in the vicinity of 15 percent.

Public transportation

Public transportation in the Port of Long Beach is provided primarily by the Long Beach Transit Company. The southeast basin is served by bus Route 14, which is on Ocean Boulevard between the downtown area and Terminal Island, and by bus Route 12, which serves the Queen Mary area from the central business district. Bus Route 14 patronage is about 2,800 passengers per day with headways of 15 minutes during peak periods. Bus Route 12 carries about 330 passengers per day on an average weekday with bus headways of 30 minutes (CP&A, 1975).

Rail traffic

The east and southeast basins of the Port of Long Beach, which handle most of the dry bulk and general cargo activity, have a good rail network to all piers. In fiscal year 1974-75, the rail traffic in and out of the Port consisted of about 27,000 cars with the peak month occurring in July (3,368

cars). The existing rail network readily accommodated these traffic demands (CP&A, 1975).

2.1.14.3 Pipeline route crossings

A detailed list of route crossings appears in Chapter 1, Section 1.4.3.2. Outside of the Los Angeles metropolitan area the proposed route crosses the 16-inch Four Corners pipeline between Redlands and Indio. To the east, there are no major crude oil transportation lines in the corridor until the El Paso area. From the El Paso station to Guadalupe, the proposed route roughly parallels the route of the Chevron 20-inch crude line running between Wink and Midland. It crosses this line between the Guadalupe and Pecos stations. Entering Texas near the Jal station, the proposed route encounters the pipeline congestion of the Permian Basin (The Oil and Gas Journal, 1973).

The proposed SOHIO crude pipeline roughly parallels the refined-products line of the Southern Pacific Pipeline Company between Los Angeles and El Paso. From El Paso to Midland, the route parallels that of the 8-inch Chevron refined-products pipeline. Entering the Midland area the proposed line crosses the Mid-American 8-inch line, a 10-inch natural gas liquids line, the Phillips 8-inch natural gas liquids line, the Mid-American natural gas liquids line, the Chaparral 10-inch products line, and the Gulf 6-inch and 8-inch natural gas liquids line (The Oil and Gas Journal, 1973).

Highways and railroads

Table 1.2.3.2-1 is a list of highway and railroad crossings for the proposed pipeline system. It can be noted from this table that the density and number of highways and railroads crossed decrease from west to east with decreased urbanization.

Water transport

The U.S. Army Corps of Engineers classifies a portion of the Los Angeles River and Colorado River as navigable waterways. The new pipeline would be buried at all water crossings, except for the concrete-lined section of the Los Angeles River flood control System. This river is considered navigable for the last 2 miles of its course before it flows into San Pedro Bay. Upstream from the 2-mile mark, the channel is concrete-lined. The proposed route crosses the river above this point, and follows the existing flood control channel for approximately 36.0 miles up the Los Angeles River to the Rio Hondo, through Whittier Narrows and the San Gabriel River, to San Jose Creek.

The Colorado River is considered navigable at the point of the proposed pipeline crossing in the vicinity of Blythe, California. In Los Angeles, Riverside, and San Bernardino counties, the proposed pipeline also crosses a total of 135 streams, which are not considered navigable by the U.S. Army Corps of Engineers.

Across the Colorado River in the Colorado River basin are the Gila River, the Santa Cruz River, the San Pedro River, and the normally dry Centennial, Waterman, and San Cristobal washes. The Florence Canal and Florence-Casa Grande River in Pinal County and the San Simon River in Cochise are also water crossings in the basin.

Dry Lake in Hidalgo County, New Mexico, the Rio Grande in Dona Ana, and the Pecos River in Eddy County, New Mexico, form the major water crossings in the Rio Grande basin. Limited water resources in the Texas area make consideration unnecessary. All waterways and streams are shown in Maps 2.1.5-1 through 2.1.5-12, Attachment 1.

2.1.14.4 Air transport

Commercial air service is available to major cities and towns along the proposed pipeline route. Air terminals within the proposed pipeline corridor include Long Beach, Compton, Ontario International, Morrow Tri-City, Banning, Palm Springs, Bermuda Dunes, Blythe, and Heron in California. These airports within the vicinity of the proposed pipeline corridor are shown in Maps 2.1.14-1 through 2.1.14-12, Attachment 1.

Most facilities for air transport along the existing pipeline corridor are small landing strips adjacent to the El Paso Natural Gas Company line and compressor stations. There are airstrips at Wenden Compressor Station (Yuma County), Gila Compressor Station (Maricopa County, Arizona), Deming (Luna County, New Mexico), and Guadalupe Compressor Station (Culberson County, Texas) near the intersection of Texas Field Marker (FM) 1165 and Texas FM 662.

Airports in the cities along the route include Casa Grande Municipal (Arizona), Lordsburg (Hidalgo County, New Mexico), Deming (Luna County, New Mexico), and El Paso, Texas. In the northeastern part of Hudspeth County, Texas, a privately operated emergency landing strip is located.

2.1.14.5 Midland terminal area

The complex pipeline network in the Midland area differs from that in the Los Angeles area, since few refined products lines are involved. Most product pipelines are actually natural gas liquids lines routed out of the area to refineries on the Gulf and in northern Texas and Oklahoma.

Crude gathering systems and transportation systems are more numerous and of greater complexity. Main crude transportation lines out of (and, in one case, into) the Midland and surrounding areas, their destinations, their

capacities, and current throughputs are shown in Table 2.1.14.5-1. Product pipelines for the Midland area may be found in Table 2.1.14.5-2.

2.1.15 Utility networks

The proposed pipeline route intersects approximately 20 electrical transmission lines in Los Angeles County, 7 in San Bernardino County, and 12 in Riverside County.

Power to each of the 18 pump stations along the route would be supplied from utility companies serving each area. Overhead electric power lines would be the source of delivery.

In Arizona, power lines are crossed 31 times. Across the Colorado River into Maricopa County, transmission lines cross the pipeline route three places in agricultural land just west of Centennial Wash. Another crossing is east of the Arlington Wildlife Area, two are by U.S. Highway 80, and one is along the Southern Pacific Railroad tracks. Pinal County has 19 crossings: One is just over the county line in cultivated fields; 5 are west of Casa Grande, 10 are east of the Casa Grande and one follows the Florence-Casa Grande Canal; another is northwest of Tom Mix Monument and one is west of the Oracle Pump Station. There is only one transmission crossing in Pima County; it is along the San Pedro River. Four crossings over existing lines are in Cochise County: One is north of Willcox; one is along Interstate 10 and U.S. Route 666 northeast of Willcox; one is south of Bowie crossing and another is a short distance east along Southern Pacific Railroad rights-of-way.

The existing pipeline crosses transmission lines in New Mexico 10 times. One line crosses in Hidalgo County just east of Lordsburg along the Southern Pacific Railroad tracks. Luna County has nine crossings in the existing pipeline right-of-way. Of two in open space, one follows another existing pipeline corridor; another lies east of the airstrip by Deming Compressor

Table 2.1.14.5-1

Main Crude Pipelines out of the New Mexico, Midland, Lubbock, Abilene, and San Angelo Areas

COMPANY	Size Inches	From	Destination	Reported Capacity bbl/d	Throughput bbl/cd	Comments
Chevron	20	Wink	El Paso	110,000	88,000	Limited by capacity of refineries at El Paso.
Exxon Pipeline Co.	18	Midland	Houston	105,000	Not Completely Full	
	12	Midland	Corpus Christi	55,000	Not Completely Full	
Rancho Pipeline Co.	24	McCamey	Houston	380,000	330,000	
Phillips Pipeline Co.	12	Midland	Borger	105,000	100,000	Carries 15,000 bbl/d of imported crude from the Gulf plus 85,000 bbl/d from Midland area.
Shell Pipeline Co.	10	Midland	Oklahoma	36,000 (48,000 bbl/d in Texas section)	36,000	Limited in capacity at river crossing into Oklahoma.
Basin Pipeline Co.	22	Midland	Oklahoma	360,000	360,000	Full.

Table 2.1.14.5-1 (Continued)

COMPANY	Size Inches	From	Destination	Reported Capacity bbl/d	Throughput bbl/cd	Comments
Texas/New Mexico Pipeline Co.	12	New Mexico	Houston	60,000	60,000	Full.
American Petrofina Pipeline Co.	10	Midland	Corpus Christi	48,000	15,000	Carrying Foreign crude to Odessa for transshipment to Borger.
Amoco Pipeline Co.	10/16(2)	Midland and Kent Co.	Oklahoma Houston (or north)	285,000 30,000	Full Full	Connects to lines north and south
Mesa Pipeline Co.	24/26	Midland	Port Arthur	410,000	380,000	Connects to West Texas Gulf 26" at Colorado City.
Mobil Pipeline Co.	8/12	Midland	20" to Illinois 12" to Longview	75,000 150,000	Full Full	Two 12" and one 16" at Abilene
	14/20	Abilene				
SOHIO	10	Midland	Port Arthur	61,000[a]		

[a] Estimate based upon a velocity of 7.11 feet/second at pumping temperature.

Table 2.1.14.5-2

Products Pipelines in the Midland Area

COMPANY	Size Inches	From	Destination	Reported Capacity bbl/d	Throughput bbl/cd	Comments
Chevron Pipeline Co.	8	Midland, TX	El Paso (Chevron Refinery)	38,300[a]	7,200	Texaco and Standard use line for delivery of refined products to Midland.
Mid-America Pipeline Co.	4/6/8/10 (2)	Artesia, NM Wink, TX Odessa, TX Benecum, TX Eaden, TX Coke Co., TX Snyder, TX	Boomfield, NM Pine Bend, Minn.	61,000[a]		Nat. gas liquids only.
Chaparral	8/12	Midland, TX Wimbler Co., TX	Houston	38,300[a]		Nat. gas liquids.
Gulf Pipeline Co.	6/8/10 (2)	Crane Co., TX Monument Co., NM Scurry Co., TX Taylor Co., TX	Houston	140,000	140,000 (Full)	Nat. gas liquids (full).

[a] Estimated capacity.

Table 2.1.14.5-2 (Continued)

COMPANY	Size Inches	From	Destination	Reported Capacity bbl/d	Throughput bbl/cd	Comments
Trust Pipeline Co.	6	Big Spring, TX Taylor, TX	Wichita Falls, TX	20,000[a]	20,000	Refined products from American Petrofina.
Diamond Shamrock	6/8	Lubbock, TX	Houston	23,400[a]		Refined products.
Phillips Pipeline Co.	8	Goldsmith, TX	Borger and Chicago	38,300[a]	Full	Nat. gas liquids to Borger. Refined products Borger to Chicago.
Phillips Pipeline Co.	10	Regan Co., TX	Sweeny, TX	61,000[a]		Nat. gas liquids.
Mobil Pipeline Co.	8/12	Midland, TX		45,000	Full	Nat. gas liquids.

station; and five are in the immediate vicinity of the south part of Deming. In Dona Ana County, just before the existing El Paso line swings into Texas, another transmission crossing is made.

Crossings in Texas are minimal. Just into El Paso County one line is crossed. One line is crossed at the pipeline intersection with Highway 54, and another lies just outside the boundary of Fort Bliss Military Reservation. Two crossings are made in Hudspeth County as the existing line moves into the county eastward. Upon reentry into Texas, the proposed route crosses the North Cowden Oil Field in Andrews and Ector counties. There are several transmission-line crossings in this area and three more in Midland and Martin counties as the proposed route moves into Midland.

2.1.16 Socioeconomic conditions

2.1.16.1 Sea Leg

Commercial fishing

Between 1970 and 1971, the commercial fisheries of the Pacific Coast states of Alaska, Washington, Oregon, and California had landings of 1.3 billion pounds which were worth $219.2 million. These figures represent a decline of 14 percent in weight and 7 percent in revenue. The principal declines were in anchovies, halibut, sea herring, salmon, albacore, and yellowfin tuna, Dungeness crabs, and ocean perch (USDC, 1966). Between 1971 and 1972, the landings increased in both weight and dollar value. There were, however, further declines in salmon and Dungeness crabs.

In 1971, the Pacific Coast states realized 25 percent of the volume and 34 percent of the value of all U.S. landings and exceeded all other areas in value. California led in volume and value of landings. Alaska was second. In 1972, the Pacific Coast states had 28 percent of the volume and 35 percent of the value of all U.S. landings, and again exceeded all other

areas in value. California led in volume, followed by Alaska, Washington, and Oregon. Alaska led in value, followed by California, Washington, and Oregon.

Alaska fisheries. Commercial fisheries activity constitutes the oldest industry of major importance in the area of the Gulf of Alaska. The industry has changed substantially during the last two decades and continues to be modified as a result of both biologic and economic stimuli. The salmon fishery has always been the major component of the industry in terms of both volume and value. In 1975 the wholesale value of the commercial fishing products in Prince William Sound was approximately 18 million dollars. Half of the dollar value was in canned pink salmon (see Table 2.1.16.1-1), 10 percent of the value was in canned sockeye salmon, and 6.5 percent was in canned tanner crab. In this same area during 1975, there were only four subsistence fishing permits issued. Subsistence fishing plays a very minor role in comparison to commercial fishing.

Table 2.1.16.1-1

Wholesale Value[a] of all Fishery Products From the Prince William Sound Area by Species, 1975

SPECIES	Type of Product	Cases	Pounds (Mostly Net Wt.)	Wholesale Value (in Thousands)
King salmon	Canned	370		$ 19.1
	Fresh, frozen		361,191	374.7
Sockeye salmon	Canned	43,646		1,998.8
	Fresh, frozen		853,602	743.3
Coho salmon	Canned	3,143		96.4
	Frozen		540,160	534.0
Pink salmon	Canned	155,661		9,229.4
	Frozen		215,237	162.3
Chum salmon	Canned	7,277		340.5
	Frozen		94,601	85.4
Dungeness crab	Frozen		838,049	705.8
Tanner crab	Canned	39,137		1,170.8
	Frozen		2,130,896	614.3
King crab	Frozen		19,719	22.0
Shrimp	Frozen		990	3.4
Herring	Bait		208,180	37.5
	Roe		327,208[b]	47.3
	Spawn on kelp		683,365	923.9
Salmon eggs	Food, salted		213,240	727.0
Halibut	Frozen		60,029	81.8
Razor clams	Food, frozen		6,406	28.8
	Bait		4,183	2.2
Bottom fish	Food, Frozen		11,750	4.3
	Bait		2,750	0.6
Total product		249,234	6,571,556	$17,953.6

Source: State of Alaska, Department of Fish and Game, Prince William Sound Annual Management Report, 1975.

[a] Data from annual report of operators. 38 operators filed intents to operate.

[b] Includes weights of frozen herring and salted roe.

The groundfish fisheries of the Gulf of Alaska are dominated by the large Russian and Japanese trawling fleets. Since 1962, these fleets have fished from the Aleutian chain to the coasts of Washington and Oregon. In recent years, the foreign fleets have caught approximately 230,000 metric tons annually, valued by U.S. standards at $48 million. Total foreign fleets at their peak represented a capital investment of about $700 million (Rosenberg, 1972).

California Fisheries. By far the greatest quantity of California commercial fish resources are landed in the southern part of the state, principally at Terminal Island in the Los Angeles area. However, of the 483,376,887 pounds (219,318 metric tons) of fish landed at Terminal Island, fully 207,804,335 pounds (94,285 metric tons) or 43 percent were derived from waters south of the state in 1973. A similar situation exists in San Diego. A total of 70,658,164 pounds (32,059 metric tons) of fish and invertebrates were landed in 1973, with 67,492,467 pounds (30,623 metric tons) or 96 percent being taken from water south of California. However, the total tonnage of fish landed in the Los Angeles and San Diego areas, about 137,169 metric tons, (excluding foreign caught species) exceeds that amount captured in the remainder of the state, regardless of source, by more than a factor of 2. Thus, southern California's marine resources represent a disproportionately large share of the state's total. The species complex predominantly captured south of the state are tunas, at 284,365,029 pounds (129,022 metric tons), with yellowfin tuna representing the bulk of this catch at 232,767,245 pounds (105,611 metric tons).

Pacific Coast troll salmon. Preliminary estimates place the 1975 troll catch of Chinook and coho salmon for Alaska, British Columbia, Washington, Oregon, and California at 49.9 million pounds. The average annual catch from 1965 through 1974 was 64.4 million pounds. Estimated Chinook catches, at 28.4 million pounds, were better than the 10-year average of 26.9 million pounds. Coho catches were generally poor from California to Alaska.

Annual catches vary widely, as illustrated by comparing the data for troll catches of Chinook salmon in 1974 and 1975 (Table 2.1.16.1-1A). The poor coho landings in 1975, consequently, are not alarming.

Table 2.1.16.1-1A

Salmon Trawl Landings[a] by Region

REGION	Chinook Salmon 1975	Chinook Salmon 1975	Chinook Salmon 10-year	Coho Salmon 1975	Coho Salmon 10-year
Alaska	4.5	3.8	4.5	0.9	4.1
British Columbia	13.5	12.7	11.8	9.4	18.4
Washington	4.3	2.8	2.5	5.1	5.2
Oregon	2.6	2.7	1.7	4.7	6.7
California	5.8	6.4	6.4	1.4	2.7

Source: California Department of Fish and Game.

[a] In millions of pounds; 10-year mean for 1965 through 1974.

Troll pink salmon fishery. The Alaska troll fishery landed about 0.25 million pounds of pink salmon in 1975. This was approximately 0.1 million pounds less than the 1974 landings. Landings of pink salmon in British Columbia totalled about 3.9 million pounds. This was an increase of 1.8 million pounds over 1974 landings, reflecting the dominance of pinks in odd-numbered years in southern British Columbia and Washington. Washington landings were about 0.34 million pounds, and Oregon landings were about 1,000 pounds. Estimates of pink salmon landings in California are not yet available.

Pacific Coast groundfish fishery. In 1975, Pacific Coast groundfish landings by American and Canadian trawl fishermen were 160 million pounds (Table 2.1.16.1-2). This total was 2 percent above both the 1974 landings and the 10-year average of 157 million pounds.

Table 2.1.16.1-2

Trawl Landings by Region[a]

REGION	1974	1975	Percent Change	10-year Mean
Alaska	692	143	-79	-
Washington	43,595	37,491	-14	53,296
Oregon	19,660	19,301	-2	22,209
California	54,864	57,927	+6	42,193
Total U.S.	118,811	114,862	-3	117,698
British Columbia	38,501	45,630	+19	39,486
Total (U.S. and Canada)	157,312	160,492	+2	157,184

Source: California Department of Fish and Game.

[a] In thousands of pounds, 1974 vs. 1975 and 10-year mean (1965 through 1974).

The Alaska trawl fishery for groundfish is still undeveloped. In 1975, Alaska trawl landings totalled 143,000 pounds. Washington estimated trawl landings in 1975 of 37 million pounds, representing a decline of 14 percent from 1974 landings of 44 million pounds and 30 percent from the 10-year average of 53 million pounds. Lower demand for animal food and reduction products accounted for most of the decline in Washington landings. Market demand was also a factor in the Oregon fishery decline.

Major trawl species -- Pacific cod, Dover sole, and other rockfish continued to dominate coastal landings in 1975. Landings of each species or group were above the past 10-year averages, and each exceeded 29 million pounds. Petrale sole and English sole landing trends since 1956 have been relatively stable, while landings of other major species have fluctuated (Figure 2.1.16.1-1).

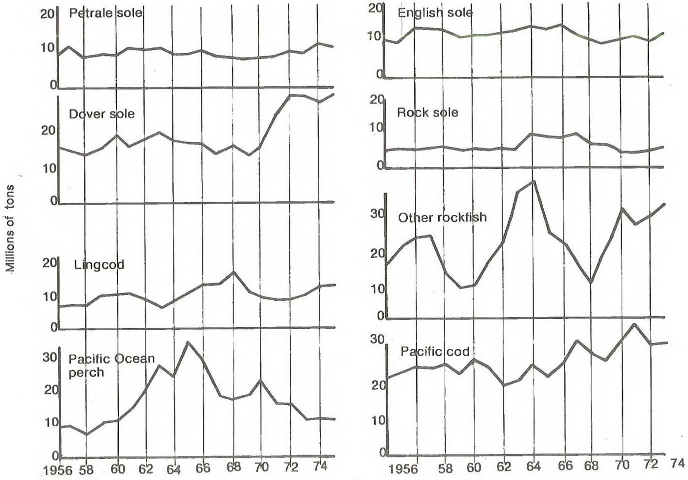


Figure 2.1.16.1-1 Pacific coast bottom-fishing catch, 1956-1974

Longline landings -- Longline landings of groundfish in 1974, based on the most current data available and exluding Pacific halibut, were 6.2 million pounds. U.S. landings were 4 million pounds, of which 3.4 million were landed in California. The leading species in U.S. line landings were rockfish, sablefish, and lingcod. Canadian landings were 2.2 million pounds, of which 1.6 million pounds were dogfish. Coastal line catches in 1974 declined greatly from those of 1973, partly because of conversion from line to trap gear by Pacific Coast fishermen.

Pot landings -- Groundfish landings by pot fishermen continued to increase in 1974 when 7.5 million pounds were landed. Sablefish comprised all but 50,000 pounds of the 7.5 million pounds. U.S. fishermen landed 6.8 million pounds while Canadian fishermen landed 0.7 million pounds. California led with 6.3 million pounds of sablefish taken by pot gear.

The Prince William Sound, Copper River, and Bering River areas of Alaska represent a relatively minor king crab fishing area when compared against Cook Inlet, Kodiak Island (South Alaska Peninsula), and Southeastern Alaska. A general increase in catch occurred from 1965 to 1968 reaching a peak of 199,600 pounds taken in 1968. In 1969, commercial catch of king crab dropped to the 1967 level. The reduction in catch from 1968 to 1969 in the Prince William Sound area is consistent with all major king crab fishery areas in the Gulf of Alaska (Eldridge, 1972).

Tanner crabs have the potential of the important commercial species in the Gulf of Alaska. The success of the tanner crab fishery in the Bering Sea, as well as the declining catches of king crab in Alaskan waters, has led to the development of an American fishery for tanner crab in Gulf of Alaska waters. _Chionoecetes bairdi_ is the most important commercial species (Brown, 1971; Slipp, 1952).

The primary tanner crab fishing areas are located at Kodiak Island, Cook Inlet, and Prince William Sound. The Prince William Sound tanner crab

fishery contributed 7.5 percent and 8.4 percent of the Alaska tanner crab catch in the years 1968 and 1969, respectively. These percentage would have an approximate dollar value of $24,000 and $95,000, respectively (Eldridge, 1972).

Most of the Dungeness crab is caught at Kodiak Island, Cook Inlet, and Prince William Sound. The Copper River, Bering River and Prince William Sound areas exhibit variable catches of Dungeness crab, ranging from a maximum of 2.3 million pounds (1,043 metric tons) in 1965 to a minimum of 1.0 million pounds (454 metric tons) in 1967 (Mayer, 1973). These catches represented approximately 23 percent and 8 percent of the total Alaskan catch for the years 1965 and 1967, respectively. The central area of Alaska (including Prince William Sound) was the most productive in terms of 1969 catch and the most profitable in both value to fishermen ($1.1 million) and wholesale market value ($2 million).

Pacific Coast albacore fishery. Pacific albacore make annual trans-Pacific migrations which subject them to three major fisheries on both sides of the North Pacific. It is generally accepted that all three fisheries are exploiting a single stock composed of six- or seven-year class groups. Pacific Coast Albacore have extremely complex and little-understood migration patterns. The total harvest from the three fisheries approximates 160 million pounds annually and represents more than 35 percent of the world albacore catch. Typically, the American albacore catch averages 44 million pounds annually, and the U.S. catch for 1975 was roughly 38 million pounds (Table 2.1.16.1-3).

Table 2.1.16.1-3

Albacore Landings in California, Oregon, and Washington[a]

YEAR	California	Oregon	Washington	Total
1951	30,915	2,917	625	34,457
1952	49,804	2,586	177	52,567
1953	33,836	776	89	34,701
1954	26,107	469	421	26,997
1955	29,002	503	233	29,738
1956	37,055	3,654	630	41,339
1957	43,525	2,702	433	46,660
1958	27,188	9,754	1,503	38,445
1959	32,740	10,582	2,961	46,283
1960	35,113	4,563	526	40,202
1961	29,123	3,251	456	32,830
1962	36,622	8,936	365	45,923
1963	48,860	11,413	527	60,800
1964	42,551	4,452	1,055	48,058
1965	23,218	12,122	2,048	37,388
1966	18,189	18,041	1,101	37,331
1967	17,858	29,243	1,240	48,341
1968	15,077	37,752	3,050	55,879
1969	14,722	29,828	3,561	48,111
1970	29,932	21,779	4,390	56,101
1971	36,082	8,420	5,250	49,752
1972	21,001	23,560	16,239	60,800
1973	8,458	16,350	14,446	39,254
1974	11,700	25,225	17,983	54,908
Average[b]	29,112	12,037	3,305	44,454
1975	8,304	15,558	15,060	38,922

Source: Washington Dept. of Fisheries.

[a] In thousands of pounds.

[b] Average for 1951 through 1974.

Development of the summer and fall fishery off the Pacific Coast of the U.S. and Canada varies each year according to fluctuations in the northerly migrations of the fish. During years of restricted northerly migrations, the fishery usually occurs off Baja and southern California. In years of more extensive migrations, commercially significant catches are made as far

north as British Columbia, with resultant shortened seasons and small total catches to the south.

Albacore movement northward along the Pacific Coast correlates well with shifting of the 50° to 66°F isotherms. Forecasting the duration and stability of these optimum water conditions in the eastern and southern portions of the range is useful in predicting the nature of the upcoming season. However, short- and long-term meteorologic and oceanographic phenomena may produce situations counter to established trends, thereby causing the less understood annual fluctuations in the range and character of the fishery.

Albacore is a species of tuna noted for the quality of its flesh, and is high on the ocean food chain. There is evidence that hydrocarbon contamination of fish species is stored in the lipid system (see Section 3.1.16.1.2). There have been many cases of decline in a fishing industry caused by lowered quality of harvested flesh. In varying degrees, all fishing industries discussed above, as well as sports fishing, are vulnerable.

<u>Salmon and steelhead sport catches in the Pacific Coast states</u>

The estimated total sport catch of salmon and steelhead during 1974 in the states of Washington, Idaho, Oregon, and California was 2.4 million fish. This catch was composed of approximately 2 million salmon and 0.4 million steelhead.

<u>Washington</u>. Approximately 500,000 fisherman took to Washington waters in 1974 and harvested approximately 1.3 million salmon. This near-record catch, exceeded only by the 1.34 million caught in 1971, consisted of 1.23 million marine and approximately 88,000 freshwater fish.

The number of salmon anglers consisted of approximately 400,000 Washington residents, 95,000 residents from other states, and approximately 6,000 from Canada and other countries. Of the total number of anglers, it was estimated that about 500,000 fished in marine waters and 35,500 fished in freshwater.

Oregon. The Oregon sport catch of salmon and steelhead in 1974 was approximately 0.7 million fish; 0.5 million salmon and 0.2 million steelhead. The catch of both salmon and steelhead was more than in 1973 and above the past 10-year average.

A total of 420,000 anglers received Oregon salmon and steelhead licenses in 1974. Of these, 24 percent reported they did not fish. When only those who fished were considered, the average annual catch per angler was two fish.

The Oregon offshore sport salmon fishery included approximately 336,000 angler trips to harvest over 351,000 salmon (318,000 coho, 33,500 Chinook, and 50 pink) and 1,500 steelhead. In coastal streams, anglers caught approximately 53,000 salmon and 123,000 steelhead.

California. Ocean salmon sport landings for 1974 show that ocean anglers landed approximately 234,000 salmon; the recent 10-year average was 172,000 salmon.

Between 1970 and 1972 the value of landings on the Pacific Coast increased by 12 percent (Table 2.1.16.1-4). The state of Washington's catch increased in value by 30 percent and Oregon's catch increased by only 4 percent. California's and Alaska's value increased by 15 percent and 6 percent, respectively.

Table 2.1.16.1-4

Pacific Coast Fisheries Summary of Landings

STATE	1970 (Million Dollars)	1970 (Million Dollars)	1970 (Million Dollars)
Alaska	96	84	102
Washington	30	32	39
Oregon	23	17	24
California	86	86	99
Total	235	219	264

Source: U.S. Department of Commerce 1970, 1971, 1972.

California kelp harvesting. The southern California region has approximately 75 square miles of kelp beds. The kelp beds are leased and harvested by kelp companies. Since kelp is subjected to change in environmental conditions, the amount available for harvest can vary annually. Temperatures above 66°F (18.9°C) are not conducive to growth and reproduction of *Macrocystis*, and can affect the standing crop. For example, in 1957-58, warm water was present throughout most of the Southern California Bight. The result of this anomaly was a great decrease in harvest, estimated between 10 and 20 percent of normal (State of California, 1964).

Macrocystis, the giant kelp, has been commercially harvested in coastal California waters since 1910. The kelp contains carbohydrates, minerals, vitamins, and algin, which is a colloidal substance extracted from the kelp. This substance has a commercial value in that algin has suspending, stabilizing, emulsifying, gel-producing, film-forming, and colloid-forming properties which are useful in many processes. There are currently more than 200 uses for algin (Frey, 1971). Red algae are useful for another commercial substance, agar, which is a group of gelatinous compounds used widely in the medical, food, textile, paper, film, tanning, and other industries (McRoy, 1971).

The annual California kelp harvest has varied over the years, reaching a high of 395,000 wet tons (358,265 metric tons) in 1918 and a low of 260 tons (236 metric tons) in 1931. An average of 129,000 tons (117,000 metric tons) was harvested yearly between 1960 and 1969 (Frey, 1971). The fluctuations in this harvest are shown in Table 2.1.16.1-5.

Table 2.1.16.1-5

California Kelp Harvest in Tons

YEAR	Open Beds	Leased Beds	Total Tons
1956	35,476.50	82,330.00	117,815.50
1957	32,810.75	61,396.50	92,207.25
1958	41,105.75	72,955.75	114,061.50
1959	42,280.65	47,309.45	89,509.10
1960	61,914.95	58,384.85	120,299.80
1961	71,952.70	57,303.30	120,256.00
1962	86,227.70	54,005.10	140,232.80
1963	57,517.00	63,514.80	121,031.80
1964	35,502.90	91,660.85	127,253.75
1965	33,464.10	101,664.90	135,129.00
1966	11,100.70	108,363.20	119,463.90
1967	9,331.00	122,164.00	131,495.00
1968	20,388.20	114,465.15	134,853.35
1969	10,028.70	121,210.50	131,239.20
1970	8,058.00	118,981.00	127,039.00
1971	19,476.00	136,083.00	155,559.00
1972	12,332.00	150,179.00	162,511.00
1973	24,539.00	128,541.00	153,080.00

Source: McAllister, 1976.

2.1.16.2 <u>Long Beach area</u>

The market area served by the Port of Long Beach contains more than 26 million people and extends over the southern portion of California, southern Nevada, southern Wyoming, west Texas, and the states of Arizona, Utah, Colorado, and New Mexico.

The local southern California trade area covers more than 13.9 million persons with an annual personal income exceeding $60 billion. In addition, the port serves the nation's second largest concentration of industrial activity, that which has developed in the Los Angeles-Orange counties metropolitan area over the last 50 years. A significant portion of the commerce developed in this market area is dependent on ocean shipping in international and coastal trade.

On the other end of the ocean trade routes are five foreign trade regions which use the Port of Long Beach. The trading countries in these regions have an estimated population in excess of 3 billion people. Of more than 29.8 million tons of cargo moved through the Port of Long Beach in the fiscal year 1973-74, nearly 19.1 million tons were to and from these countries.

The relationship and importance of the port to its market area can be found in the way port activity follows economic activity in the market area. Based on the 1940 census and the 1970 census, the population of southern California increased at an average annual rate of 6.9 percent. For this same period the economic index of the area has increased at approximately 5.7 percent annually. Port activity, as indexed by tonnage, closely parallels economic activity growth. The Port of Long Beach share of this waterborne commerce has been steadily increasing. In the last 10 years, inbound and outbound cargo movement has more than doubled, increasing from over 11 million tons in 1963-64 to over 29.8 million tons in 1973-74. This amount of cargo makes the Cargo Port of Long Beach the leading port on the

U.S. Pacific Coast. Both gross and net revenues to the Port have shown comparable increases in this same time period, reflecting the constant development of port facilities as a result of the growth of commerce.

The most recent commodity ranking available is for calendar year 1973 (Table 2.1.16.2-1).

Table 2.1.16.2-1

Cargo Volume by Commodity Group Through Long Beach Harbor

COMMODITIES	Thousands of Tons	Percentage of Total San Pedro Bay Tonnage
Crude petroleum	11,907	61
Petroleum and coal products	5,403	35
Primary metal products	4,684	78
Chemical & allied products	724	40
Farm products	1,176	72

Source: Port of Long Beach, 1976.

Petroleum products and chemical products are more heavily concentrated in Los Angeles Harbor than in Long Beach.

The total value of cargoes handled by the Port of Long Beach has increased from $221 million in 1949-50 to $756 million in 1959-60: to $1.8 billion in 1969-70: to $5.6 billion in 1973-74 (Port of Long Beach, 1976). The growth in traffic at the port has resulted in its becoming the busiest port on the West Coast. It is also the third busiest container port in the United States, surpassed by only New York and Oakland.

The Port operates as a self-supporting economic system. Revenue produced from invested capital provides operating funds and most of the money for capital improvements. This is sometimes augmented by the sale of revenue bonds for specific capital improvement projects. As a result, the total

municipal Port investment of 30 June 1974, including operating facilities, roads, railroads, and the public utilities necessary to the functioning of the Port, was about $258 million.

Direct and indirect revenues generated in the port by the transshipment of cargo amount to an estimated $2.5 billion annually. Payments for ship services, such as food and water supply, crew expenditures and cargo handling jobs, amount to about $240 million annually. Indirect and secondary revenues, including the income and payroll resulting from export cargo manufacturing and handling, the income and payroll from import cargo distribution and marketing, and retail sales and other services to the payroll earners are estimated to be about $2.1 billion annually. The Los Angeles Customs District collected more than $194 million in duties on cargo shipped through the Port of Long Beach in one year. Taxes in excess of $7 million are paid each year by property owners and tenants within the harbor district in support of local schools, the city, and county governments.

2.1.16.3 Pipeline route

California population

Table 2.1.16.3-1 shows population and related change for Los Angeles, San Bernardino, and Riverside counties in California. Los Angeles County has remained the population center of the region with 85 percent of the three-county area's population living there in 1974. While Los Angeles lost slightly in its relative proportion between 1960 and 1975, San Bernardino and Riverside counties gained slightly.

Between 1960 and 1970, the area grew 1.79 percent annually. Los Angeles grew at a slower rate; Riverside and San Bernardino grew at faster rates. After 1970, the population declined slightly and the growth became negative averaging -.03 percent per year.

Table 2.1.16.3-1

Study Area Population

COUNTIES	I Population 1960	I Population % of State Subtotal	II Population 1970	II Population % of State Subtotal	1960-1970 Annual Average Percentage Change	III Population Est. 1974	III Population % of State Subtotal	1970-1974 Annual Average Percentage Change
California								
Los Angeles	6,038,771	88	7,032,075	86	1.53	6,955,500	85	- .27
San Bernardino	503,591	7	684,072	8	3.11	694,600	9	.38
Riverside	306,191	5	459,074	6	4.13	514,200	6	2.88
Subtotal (Cols. I, II, and III)	6,848,553	100	8,175,221	100	1.79	8,164,300	100	- .03
Arizona								
Yuma	46,235	4	60,827	4	2.78	68,300	4	2.94
Maricopa	663,510	61	968,487	64	3.85	1,172,000	64	4.88
Pinal	62,673	6	68,579	5	.90	80,500	4	4.09
Pima	265,660	24	351,667	23	2.84	434,000	24	5.40
Cochise	55,039	5	61,918	4	1.18	75,400	4	5.05
Subtotal (Cols. I, II, and III)	1,093,117	100	1,511,478	100	3.29	1,830,200	100	4.90

Source: William Bros., 1976.

Table 2.1.16.3-1 (Continued)

COUNTIES	I Population 1960	I % of State Subtotal	II Population 1970	II % of State Subtotal	1960-1970 Annual Average Percentage Change	III Population Est. 1974	III % of State Subtotal	1970-1974 Annual Average Percentage Change
New Mexico								
Hidalgo	4,961	3	4,734	2	- .47	5,200	2	2.38
Grant	18,700	9	22,030	11	1.65	23,400	11	1.52
Luna	9,839	5	11,706	6	1.75	14,200	7	4.95
Dona Ana	59,948	30	69,773	35	1.53	78,000	37	2.83
Eddy	50,783	26	41,119	21	-2.09	40,400	19	- .44
Lea	53,429	27	49,554	25	- .75	50,400	24	- .42
Subtotal (Cols. I, II, and III)	197,660	100	198,916	100	.06	211,600	100	1.56
Texas								
El Paso	314,070	63	359,291	67	1.35	410,000	69	3.36
Hudspeth	3,343	1	2,392	1	-3.29	2,900	1	5.63
Culberson	2,794	1	3,429	1	2.07	3,400	1	- .21
Ector	90,995	18	91,805	17	.09	93,900	16	.57
Andrews	13,450	3	10,372	2	-2.57	10,500	2	.31
Martin	5,068	1	4,774	1	- .60	4,500	1	-1.47
Midland	67,717	14	65,433	12	- .34	66,000	11	.22
Subtotal (Cols I, II, and III)	497,437	100	537,496	100	.77	591,200	100	2.41
Total	8,636,767		10,423,111		1.70	10,797,300		.89

Between 1960 and 1970, San Bernardino and Riverside counties grew at 3.11 percent and 4.13 percent, respectively. Los Angeles County grew at the annual average rate of 1.53 percent. Between 1970 and 1975, growth rates slowed because of a slower economy and lower birth rates. The large growth rate in the San Bernardino area during the 1960s resulted from in-migration and the availability of inexpensive land. Since 1970, however, the growth can be attributed almost completely to natural increases.

The majority of the population is in the 18-to-64 age category, suggesting that the largest segment of the population in the three-county area is in the active labor force (U.S. Dept. of Commerce, Bur. of the Census, 1972).

Tables 2.1.16.3-2 and 2.1.16.3-3 show employment, unemployment, and employment in selected occupations and percentage employed by industry for the three counties along the proposed pipeline corridor within California.

Table 2.1.16.3-2

Civilian Labor Force

Employment and Unemployment

1970 to 1976

EMPLOYMENT STATUS	California	Los Angeles	San Bernardino	Riverside
Total employment				
1970	7,484,690	2,826,565	223,263	151,760
1975	8,455,000	2,915,000	261,930	178,070
1976[a]	-	2,944,000	262,304	178,396
Total Unemployment				
1970	507,478	187,551	14,455	9,130
1975	925,000	313,000	29,420	18,530
1976[a]	-	298,500	29,689	18,711
Percent Unemployed				
1970	6.3	6.2	6.1	5.7
1975	9.9	9.7	10.1	9.5
1976[a]	-	9.2	10.2	9.5

Source: U.S. Department of Commerce, Bureau of the Census, City and County Data Book, 1972; State of California, Employment Development Department, Employment Data and Reseach Division, CETA Estimates, 1975.

[a] Estimated by BLM personnel.

Table 2.1.16.3-3

1970 Employment for Selected Occupations

California

COUNTIES	Craftsmen	Operatives Excluding Transport	Transport Equipment Operations	Laborers
Los Angeles	362,744	363,815	89,805	110,209
San Bernardino	36,211	23,618	9,125	11,354
Riverside	21,002	14,865	5,170	7,319
Total	419,957	402,298	104,100	128,882

Source: Bureau of the Census, 1970b.

The total labor force of the three counties was 3,201,388 with the 1975 total estimated at 3,228,000. The dominance of Los Angeles County as a regional labor market is indicated by the fact that, of the total labor force, 88.3 percent of the workers are there: San Bernardino has 7 percent of the total work force; 4.7 percent of the workers are in Riverside County.

In 1970, the unemployment rate for the entire State of California was 6.3 percent. This was higher than the national rate of 4.9 percent. However, each of the three California counties had unemployment rates below that of the state.

In 1975, the rate of unemployment for the state increased to 9.9 percent. Los Angeles County's rate was 9.7 percent -- below the state average, but an increase of 56 percent from the 1970 rate. Total work force increased 7.0 percent during this five-year period while total employment increased only 3.1 percent.

California minorities

In 1975, 29 percent of the labor force in Los Angeles County area were minority workers. More than one-half of these workers were Spanish surnamed and one-third were black Americans, See Table 2.1.16.3-4. The total minority unemployment rate was 22 percent higher than the rate for the entire labor force. The black unemployment rate was almost 60 percent higher. In San Bernardino and Riverside counties, minorities make up 20 percent of the total labor force see (Table 2.1.16.3-5). Spanish surnamed workers were 75 percent of this figure and black Americans were 17.5 percent. During 1975, black Americans in Riverside-San Bernardino counties had an unemployment rate of 20.6 percent which was more than 1.5 times higher than the rate for the total labor force.

Table 2.1.16.3-4

Los Angeles County Minority Labor Force and Unemployment

July, 1975

GROUPS	Labor Force	Unemployment	Unemployment Rate
Total	3,249,700	349,600	10.8
Total minority	945,600	124,400	13.2
Black	308,700	53,100	17.2
Spanish	516,700	63,300	12.3
Other nonwhite	120,200	8,000	6.7

Source: These figures were derived from projections based on 1970 census information by the State of California, Employment Development Department, Employment Data and Research Division, 1975.

Table 2.1.16.3-5

Riverside-San Bernardino Counties Minority Labor Forces and Unemployment

July, 1975

GROUPS	Labor Force	Unemployment	Unemployment Rate
Total	5,013,500	63,400	12.3
Total minority	100,700	15,000	14.9
Black	17,500	3,600	20.6
Spanish	75,500	10,600	14.0
Other nonwhite	7,700	800	10.4

Source: These figures derived from projections based on census information by the State of California, Employment Development Department, Employment Data and Research Division, 1975.

In the three California counties being traversed by the proposed pipeline, the manufacturing sector employs the largest percentage of the total labor force in 1970. This amounted to approximately 838,000 workers, or 26 percent of employed persons. Employees engaged in durable goods manufacturing number more than twice those employed in nondurable goods. The second largest employment sector is wholesale and retail trade: approximately 667,000 workers or 19.5 percent of the total labor force. The construction industry reported approximately 4 percent of the total civilian labor force in 1970. (See Table 2.1.16.3-6.)

Table 2.1.16.3-6

Employed Population by Industry

California, 1970

ECONOMIC SECTOR	Los Angeles	San Bernardino	Riverside
Agriculture, forestry, and fisheries	27,007	7,259	11,100
Mining	9,439	1,087	1,552
Construction	128,431	15,811	9,539
Manufacturing durable goods	541,610	32,340	18,280
Manufacturing nondurable goods	229,294	10,271	5,709
Transportation, communication and utilities	193,411	18,180	8,363
Wholesale and retail trade	586,267	48,025	33,005
Finance, insurance, and real estate	177,598	9,307	7,235
Business and repair services	138,820	8,188	5,160
Personal services	117,434	10,169	9,516
Entertainment and recreational services	NA	NA	NA
Professional and related services	134,624	8,599	6,164
Public administration	133,468	17,818	10,244
Industry not reported	409,162	36,209	25,893

Source: Bureau of the Census, 1970b.

The classification of the work force by occupation indicates that in 1970 clerical and kindred workers were the largest occupational category in all three California counties. Professional and technical workers rank second in Los Angeles and Riverside counties, but craftsmen, foremen, and kindred workers rank second in San Bernardino County.

The availability of construction workers, with support coming from the operatives, transport operatives and nonfarm laborers will be important during the construction phase of the pipeline. In Riverside County, the

types of workers needed for pipeline construction comprise 36 percent of the county civilian labor force.

Income. Per capita personal income as well as family income in Los Angeles County has historically been higher than either San Bernardino or Riverside counties. More than 40 percent of the families in Los Angeles County were in the $10,000 to $25,000 income range, while the majority of families in San Bernardino and Riverside counties fall into the $7,000 to $15,000 income categories (Table 2.1.16.3-7).

Table 2.1.16.3-7

Family Income by Counties

California, 1970

FAMILY INCOME	Los Angeles		San Bernardino		Riverside	
	No.	%	No.	%	No.	%
0-$2,999	136,948	7.7	16,746	9.7	13,428	11.3
$3,000-$4,999	145,115	8.2	19,368	11.2	15,065	12.7
$5,000-$6,999	173,966	9.8	20,787	12.0	14,893	12.6
$7,000-$9,999	321,392	19.2	36,629	21.2	23,427	19.8
$10,000-$14,999	489,359	27.7	46,373	26.8	29,278	24.7
$15,000-$25,000	376,204	21.3	27,416	15.8	17,326	14.6
$25,000 and Over	126,347	7.1	5,800	3.3	5,037	4.2

Source: Bureau of the Census, 1970b.

More than 16 percent of the families in the three California counties had a yearly income of less than $5,000. Riverside County had the largest percentage, with approximately 25 percent of the families in this income range.

Between 1970 and 1972, real per capita personal income increased $1,227 or 32 percent in Los Angeles County. The real gains in per capita income in

San Bernardino and Riverside counties were slightly lower but equally as impressive. During this same period, per capita income for the state grew at 2.22 percent per annum while U.S. per capita grew at the annual average rate of 3.04 percent. (See Table 2.1.16.3-8.)

Table 2.1.16.3-8

Per Capita Personal Income

California

COUNTIES	1970[a]	1972[b]	1972[c]
Los Angeles	$3,864	$5,485	$5,091
San Bernardino	3,002	3,847	3,571
Riverside	3,083	3,880	3,601

[a] U.S. Dept. of Commerce, Bureau of the Census, 1972.

[b] California Statistical Abstract, 1974.

[c] Constant 1970 dollars.

The average median for the three county areas was $9,799 in 1970 (Table 2.1.16.3-9). This was approximately 9 percent below the median income for California and 2 percent above the national median of $9,586. Riverside County had the lowest median income: approximately 16 percent below the state figure and 8 percent below the three-county median.

Housing. In 1970, the California counties of Los Angeles, San Bernardino, and Riverside had a total of 2,961,220 housing units. Of this total, 99 percent were year-round units. In 1975 the total housing units increased to 3,196,121 (Table 2.1.16.3-10). This increase in housing stock is due to a sharp decline in the average number of persons per dwelling unit. In 1970 there were 2.82 persons per dwelling unit (DU); in 1975, 2.63. If this

Table 2.1.16.3-9

Family Income Levels

California, 1970

COUNTIES	Median Family Income (Dollars)	Families Below Low Income Level Number	%	Families Below 125 Percent of Low Income Level Number	%	Per Capita Money Income (Dollars)
U.S. total	9,586	5,475,040	10.7	7,675,290	15.0	3,119
California	10,729	420,105	8.4	595,149	11.9	3,614
Los Angeles	10,968	145,085	8.2	201,704	11.4	3,864
San Bernardino	9,438	17,139	9.9	25,102	14.5	3,002
Riverside	8,992	12,912	10.9	18,953	16.0	3,083

Source: Bureau of the Census, 1972.

Table 2.1.16.3-10

Housing Units in California 1960 - 1975

AREA	1960	1970	1975	1970 - 75 Simple Annual Growth Rate	Growth Due to Change in Household Average size 1970-75	Changes in Housing Units Due to Population Growth 1970-75
Los Angeles	2,108,621	2,537,773	2,695,401	1.24	160,801	-3,163
Riverside	115,402	171,992	214,889	4.99	15,789	27,108
San Bernardino	191,668	251,465	285,831			
Total	2,415,691	2,961,220	3,196,121	1.58	205,521	29,380

Source: Southern California Association of Governments.

decline continues, the housing stock would continue to rise even though population remained constant. Annual housing production is expected to be lower than it was in the boom years of the 1960s (Southern California Association of Governments, 1976). The number of permits has fallen from 80,000 plus in 1970 to 48,929 in 1975.

In 1970 owner-occupied units comprised an average of 58.7 percent of the total year-round units. Rental vacancy rates averaged approximately 6.2 percent in 1970, homeowner vacancy rates averaged 1.8 percent, and approximately 36,000 units, 1.23 percent, were lacking in some or all plumbing facilities (See Table 2.1.16.3-10).

Median gross rent in 1970 ranged from a low of $112 in San Bernardino County to a high of $123 in Los Angeles County. The average for monthly rentals was $116 in 1970.

Arizona population

The five Arizona counties traversed by the proposed pipeline project experienced an increase of 418,361 persons between 1960 and 1970. This was a 38 percent increase. Maricopa County increased by 46 percent. Pinal County had the lowest percentage increase; i.e., 9.4 percent. This was 29 percent below the average growth rate in the area.

During 1970 to 1974, this five-county portion of Arizona continued to experience rapid growth. This area grew 21 percent with Pima County having the largest growth rate. The increase in population was caused by two factors, natural increases and net in-migration. Climate, environmental amenities, and increased employment opportunities have caused in-migration to the area. These factors, more than natural increases, have resulted in the rapid population increase.

The largest percentage of the population is in the 18-to-64 age group. Approximately 10 percent of the Maricopa and Pima counties population is 65 years and older with an upward shift occurring in this segment during the early part of the 1970s (U.S. Dept. of Commerce, Bur. of the Census, 1972).

The average median age for the State of Arizona was 26.4 years in 1970. The five-county area was below the state average with a median age of 25.4 years.

Employment. All five counties being traversed by the proposed project have shown an increase in total labor force since 1970; this amounted to a 35.5 percent increase in 1974. During the same period, Maricopa County reported a 37.2 percent increase in the labor force. Pinal and Pima counties had percentage increases in the labor force almost equal to the rate in Maricopa, but the unemployment rate in both counties increased only slightly (Table 2.1.16.3-11).

In Yuma County, approximately 36 percent of the labor force in 1975 was minority workers. Seventy-four percent were Spanish surnamed and 8 percent were black Americans (See Table 2.1.16.3-12). While the unemployment rate for blacks was slightly higher than for the entire labor force, the unemployment rate for all minorities was at the same level as the total labor force. In Maricopa County the minority workers comprised less than 20 percent of the labor force in 1975. Spanish surnamed workers were 64 percent of this total, blacks were 14 percent, and other nonwhite minorities were 22 percent. In the remaining counties in Arizona, the situation was similar. Minorities account for a sizable portion of the labor force; Spanish surnamed workers are predominant; black Americans have a higher unemployment rate than the total minority labor force.

Table 2.1.16.3-11

Civilian Labor Force, Employment and Unemployment

Arizona, 1970-1974

COUNTIES	Work Force 1970	Work Force 1974	Total Employment 1970	Total Employment 1974	Total Unemployment 1970	Total Unemployment 1974	Percent Unemployed 1970	Percent Unemployed 1974
Arizona	641,000	869,625	614,055	820,175	26,945	49,450	4.2	5.7
Yuma	20,739	24,800	19,746	23,150	993	1,650	4.8	6.7
Maricopa	376,964	517,200	362,156	487,200	14,808	30,000	3.9	5.8
Pinal	21,277	29,075	20,208	27,500	1,069	1,575	5.0	5.4
Pima	122,311	164,400	117,405	157,000	4,906	7,400	4.0	4.5
Cochise	18,559	22,175	17,621	20,875	938	1,300	5.1	5.9

Source: Bureau of the Census, 1972, Valley National Bank of Arizona, 1975.

Table 2.1.16.3-12

Arizona Labor Force - 1975

COUNTY	Labor Force	Employed	Unemployed	Unemployment Rate
Yuma				
Total	26,175	23,950	2,225	8.5
Total minority	9,600	8,750	850	8.8
Black	775	700	75	9.7
Spanish	7,100	6,475	625	8.8
Other nonwhite	1,725	1,575	150	8.7
Maricopa				
Total	532,200	474,400	57,800	10.9
Total minority	100,800	88,000	12,800	12.6
Other nonwhite	21,900	19,000	2,900	13.2
Black	14,500	12,500	2,000	13.8
Spanish	64,400	56,500	7,900	12.3
Pinal				
Total	30,250	27,575	2,675	8.8
Total minority	13,850	12,300	1,500	11.2
Black	975	850	125	12.8
Spanish	9,925	8,925	1,000	10.1
Other nonwhite	2,950	2,525	425	14.4
Pima				
Total	168,900	155,400	13,500	8.0
Total minority	47,000	43,050	3,950	8.4
Black	4,300	3,900	400	9.3
Spanish	35,300	32,350	2,950	8.4
Other nonwhite	7,400	6,800	600	8.1

Table 2.1.16.3-12 (Continued)

COUNTY	Labor Force	Employed	Unemployed	Unemployment Rate
Cochise				
Total	23,275	20,875	2,400	10.3
Total minority	7,900	7,025	875	11.1
Black	400	350	50	12.5
Spanish	6,975	6,200	775	11.1
Other nonwhite	525	475	50	9.5

Source: 1975 figures based on projection made from 1970 ratios. Arizona Department of Economic Security.

Income. Maricopa County had an increase of $1,486 in per capita personal income from 1969 to 1973. This was an approximate 17 percent real increase, and was the highest in the five Arizona counties along the proposed pipeline route. Cochise County experienced the lowest real income increase of 8 percent between 1960 and 1973. Yuma County was close with only an 8.2 percent increase (Table 2.1.16.3-13).

The average per capita money income for the five Arizona counties in 1970 was $2,712. In 1973 it was $4,462, an increase of 65 percent. However, adjusting for the rate of inflation gives a per capita income of $3,681 in 1969 dollars, an increase of only 35.7 percent (Table 2.1.16.3-14). Approximately 20 percent had incomes less than $5,000 in 1970. The largest percentage of families was in the $10,000 to $14,000 range.

Table 2.1.16.3-13

Family Income by Counties

Arizona, 1970

FAMILY INCOME	Yuma No.	Yuma %	Maricopa No.	Maricopa %	Pinal No.	Pinal %	Pima No.	Pima %	Cochise No.	Cochise %
0-$2,999	1,759	11.9	20,874	8.5	2,258	14.8	9,137	10.4	1,873	12.6
$3,000-$4,999	1,892	12.8	24,312	9.9	2,014	13.2	10,015	11.4	1,769	11.9
$5,000-$6,999	2,261	15.3	29,715	12.1	2,227	14.6	11,685	13.3	2,245	15.1
$7,000-$9,999	3,355	22.7	50,343	20.5	3,676	24.1	19,416	22.1	3,315	22.3
$10,000-$14,999	3,400	23.0	68,024	27.7	3,310	21.7	21,613	24.6	3,479	23.4
$15,000-$25,000	1,714	11.6	40,765	16.6	1,434	9.4	12,300	14.0	1,873	12.6
$25,000 and over	399	2.7	11,542	4.7	336	2.2	3,690	4.2	312	2.1

Source: Bureau of the Census, 1970.

Table 2.1.16.3-14

Per Capita Personal Income

Arizona

COUNTIES	1969	1972	1972[a]	1973	1973[a]
Yuma	$3,668	$4,172	$3,872	$4,813	$4,206
Maricopa	3,559	4,634	4,301	5,045	4,408
Pinal	2,924	3,450	3,202	4,041	3,531
Pima	3,327	4,262	3,956	4,368	3,817
Cochise	3,086	3,635	3,373	4,042	3,532

Source: U.S. Dept. of Commerce, 1975.

[a] Constant 1970 dollars.

The average median family income in 1970 was $8,650. This figure was approximately 10 percent above the state average of $7,845. Of the 378,332 families in the five-county area, 38,033 or 10 percent had incomes which were below the poverty level (Table 2.1.16.3-15). Pinal County had 17.6 percent of the families in this category.

Housing. The five Arizona counties of Yuma, Maricopa, Pinal, Pima, and Cochise had a total of 496,481 housing units in 1970. Of this total 493,766, or 99 percent, were year-round units.

Owner-occupied units comprised an average of 63 percent of the total year-round units, and renter-occupied units totaled 182,693 for the area.

Availability of these rental units is critical to the construction phase of the proposed project. There are two types of vacancy rates: vacant-for-sale and vacant-for-rent. Vacant-for-sale data are relevant to Pinal County where maintenance personnel will be located; however, as the number of these maintenance personnel is small (11 persons) and may represent some

Table 2.1.16.3-15

Family Income Levels[a]

Arizona, 1970

COUNTIES	Median Family Income (Dollars)	Families Below Low Income Level		Families Below 125 Percent of Low Income Level		Per Capita Money Income (Dollars)
		Number	%	Number	%	
Yuma	8,188	2,011	13.6	2,957	20.0	2,586
Maricopa	9,853	21,856	8.9	31,679	12.9	3,216
Pinal	7,935	2,685	17.6	3,676	24.1	2,212
Pima	8,942	9,489	10.8	13,618	15.5	2,982
Cochise	8,333	1,992	13.4	3,033	20.4	2,563

SOURCE: Bureau of the Census, 1972.

[a] Average income level for a nonfarm family of four headed by a male in 1969 was $3,745

individuals who are already local residents, the magnitude of this demand is small.

Vacant-for-sale rate in Pinal County was 1.1 percent in 1970. This is just above the "standard" vacant-for-sale rate of 1 percent, as utilized by the U.S. Department of Commerce, Bureau of the Census.

New Mexico population

In the New Mexico counties of Hidalgo, Grant, Luna, Dona Ana, Eddy, and Lea, the population increased by only 1,256 persons between 1960 and 1970. This low overall growth rate resulted from large decreases in population in Hidalgo, Eddy, and Lea counties, and since population changes are caused by either natural increases/decreases or migration, it is evident that a massive out-migration of the population occurred in those three counties.

The out-migration slowed or stopped almost completely at the end of the decade in five of the six New Mexico counties as the entire area experienced a growth rate of 6.4 percent (an increase of 12,684 persons) for the first four years of the 1970 decade. Eddy County was the only county to experience a decrease in population, but the rate of decrease dropped from 19 percent between 1960 and 1970 to a 1.7 percent.

Lack of employment opportunities on a professional or technical level is a major cause of the out-migration phenomenon. High school and college graduates are seeking employment in counties other than these in which they received their education. Increases in employment in the government sector slowed net out-migration, and are largely responsible for the population increase.

The largest percent of the population is in the 18-to-64 age group, with Luna County having more than 10 percent of the population in the 65 years and older category (Bureau of the Census, 1972).

Employment. Table 2.1.16.3-16 shows employment by industry for the six counties along the proposed pipeline corridor within New Mexico.

The total labor force in 1970 in the six counties was 70,376 workers, with a 9 percent increase from 1970 to 1973. Dona Ana County, with 26,526 laborers, was the largest supplier of workers to the labor force in the area.

During this same three-year period, unemployment rose only 5 percent. Hidalgo County had a rise in unemployment, but the 4.5 percent increase was below the state average of 5.6 percent and the average for the six New Mexico counties (Table 2.1.16.3-17).

The mining industry is especially important in Grant and Lea counties because it employs 950 workers. Wholesale and retail trades are the largest employers in Hidalgo and Luna counties, employing almost 25 percent of the 5,566 labor force. The county of Dona Ana is more service-oriented with more than 50 percent of the 19,494-member labor force in the wholesale and retail trades, professional and related services, or the government sector. Pipeline construction employees along the proposed route would probably utilize this county as a service center.

Construction employment is relatively low in each of the six New Mexico counties. Coupled with relatively low unemployment rates in the New Mexico counties, availability of a local labor pool could be a critical issue.

Minority employment. In almost all cases, Spanish surnamed minority workers had a higher unemployment rate in New Mexico than any other minority group. In Luna county the black unemployment rate was the highest in the six-county study area; this amounted to 20 workers. Lea county had the lowest rates of unemployment (see Table 2.1.16.3-17A).

Table 2.1.16.3-16

Employed Population by Industry

New Mexico, 1970

ECONOMIC SECTORS	Hidalgo	Grant	Luna	Dona Ana	Eddy	Lea
Agriculture, forestry, and fisheries	145	29	454	1,401	218	41
Mining	201	339	105	39	98	611
Construction	64	37	491	1,054	28	44
Manufacturing durable goods	0	90	70	483	0	0
Manufacturing nondurable goods	12	10	135	891	22	49
Transportation	70	30	325	924	31	30
Wholesale and retail trade	336	89	1,036	3,139	91	173
Finance, insurance, and real estate	29	20	153	681	4	13
Business and repair services	27	0	106	760	13	30
Personal services	99	65	242	1,037	91	39
Entertainment, and recreational services	0	0	39	239	0	14

Table 2.1.16.3-17

Civilian Labor Force, Employment, and Unemployment

New Mexico, 1970, 1973, 1975

COUNTIES	Work Force			Total Employment			Total Unemployment			Percent Unemployed		
	1970	1973	1975	1970	1973	1975	1970	1973	1975	1970	1973	1975
New Mexico	355,600	410,800	431,088	334,600	387,600	399,884	21,000	23,200	31,204	5.9	5.6	7.2
Hidalgo	1,561	2,213	3,177	1,505	2,113	3,038	56	100	139	3.6	4.5	4.4
Grant	7,358	8,029	8,321	6,993	7,580	7,711	365	449	610	5.0	5.6	7.3
Luna	4,004	4,422	4,494	3,676	4,091	4,117	328	331	377	8.2	7.5	8.4
Dona Ana	22,997	26,526	26,446	21,552	25,016	24,380	1,472	1,510	2,066	6.4	5.7	7.8
Eddy	15,441	15,999	17,717	14,145	15,156	16,883	756	843	834	4.9	5.3	4.7
Lea	19,015	20,190	22,317	18,255	19,478	21,592	760	712	725	4.0	3.5	3.2

Sources: University of New Mexico, 1975. New Mexico Employment Security Commission, 1976.

Table 2.1.16.3-17A

Ethnic Character of New Mexico

Civilian Labor Force, Employment, and Unemployment

1975

COUNTY	Work Force	Employment	Unemployment	Percent Unemployment
Hidalgo				
White[a]	3,177	3,038	139	4.4
Black	0	0	0	0
Other	0	0	0	0
Spanish surname[a]	1,599	1,331	268	17.19
Grant				
White	8,267	7,657	610	7.4
Black	23	23	0	0
Other	31	31	0	0
Spanish surname	3,515	3,223	292	8.3
Luna				
White	4,408	4,051	357	8.1
Black	82	62	20	24.4
Other	4	4	0	0
Spanish surname	1,599	1,433	166	10.4
Dona Ana				
White	25,933	23,892	2,041	7.9
Black	318	293	25	7.9
Other	195	195	0	0
Spanish surname	10,555	9,508	1,047	9.9
Eddy				
White	17,198	16,383	815	4.7
Black	458	439	19	4.1
Other	61	61	0	0
Spanish surname	3,326	3,022	304	9.1
Lea				
White	21,303	20,642	661	3.1
Black	424	864	60	6.5
Other	90	86	4	4.4
Spanish surname	1,670	1,555	115	6.9

Source: New Mexico Employment Security Commission, 1976

[a] Spanish surname work force is included in white category

Income. Of the six counties in New Mexico being traversed by the proposed pipeline, Hidalgo County had the most significant income change in recent years with an increase of $1,944 in per capita personal income from 1969 to 1973. This 76 percent increase was by far the largest of the six New Mexico counties (Table 2.1.16.3-18). Grant County, with an increase of 26 percent, was the lowest in the New Mexico county group, but all counties experienced steady increases during this period.

Table 2.1.16.3-18

Per Capita Personal Income

New Mexico

COUNTIES	1969	1969[a]	1972	1972[a]	1973	1973[a]
Hidalgo	$2,543	$2,693	$3,639	$3,378	$4,487	$3,920
Grant	3,159	3,346	3,746	3,477	3,969	3,468
Luna	2,681	2,839	3,060	2,840	3,523	3,078
Dona Ana	2,778	2,942	3,113	2,889	3,551	3,102
Eddy	2,861	3,030	3,369	3,127	3,883	3,393
Lea	3,106	3,289	3,567	3,310	4,132	3,610

Source: U.S. Department of Commerce, 1975.

[a] In 1970 constant dollars.

The average per capita money income in 1970 in the six New Mexico counties was $2,286. This was $151 below the state per capita money income. This was also the lowest per capita money income of any of the states in this analysis.

Approximately 27 percent of the families in the counties of Hidalgo, Grant, Luna, Dona Ana, Eddy, and Lea had incomes of less than $5,000 per year. Grant County had the lowest percent of the 13,280 families living in the county with only 8 percent falling in this income range. New Mexico

counties had the lowest family income of any state along the proposed pipeline corridor. The number and percent of families in each of the seven income groupings are presented in Table 2.1.16.3-19.

The largest percent of families in the New Mexico counties had incomes between $7,000 and $10,000 per year. Luna County is an exception to this since 19.4 percent of families are in the $5,000 to $7,000 range and 19.3 percent are in the $3,000 to $4,999 income grouping.

The average median family income in 1970 was $7,482. This was approximately 5 percent below the state average of $7,845. As with per capita income, the New Mexico counties had the lowest median income of the 21 counties along the pipeline route. Ten percent, or 8,207 families, of the total 28,544 New Mexico families in the six-county area were below poverty level in 1970. Hildalgo, Grant, and Luna counties had more than 20 percent of their families in this category.

Housing. The six counties in New Mexico had a total of 64,473 housing units in 1970. Of this total, 64,136 were year-round units.

Owner-occupied units comprised an average of 66 percent of the total year-round units with renter-occupied units totaling 2,180 for the area.

Vacant-for-sale data are relevant only to Lordsburg in Hidalgo County, and then only minimally. A nine-man maintenance team will be required to operate the maintenance station, and some of this team may already reside in the area (Table 2.1.16.3-20).

The vacant-for-rent rates in all six counties in New Mexico had vacancy rates above the "standard" of 5 percent of year-round units. Vacant-for-rent units totaled 9,378 in 1970. Eddy County had the highest vacancy rate with 24.5 percent. This high rate can be explained somewhat by the population decrease of 719 from 1970 to 1974.

Table 2.1.16.3-19

Family Income Levels

New Mexico, 1970

FAMILY INCOME	Hidalgo No.	Hidalgo %	Grant No.	Grant %	Luna No.	Luna %	Dona Ana No.	Dona Ana %	Eddy No.	Eddy %	Lea No.	Lea %
0-$2,999	207	18.4	533	10.1	492	17.2	2,357	15.1	1,686	16.0	1,484	11.3
$3,000-$4,999	174	15.4	512	9.7	553	19.3	2,544	16.3	1,464	13.9	1,274	9.7
$5,000-$6,999	240	21.3	1,046	19.8	555	19.4	2,450	15.7	1,443	13.7	1,694	12.9
$7,000-$9,999	238	21.1	1,537	29.1	427	14.9	2,981	19.1	2,423	23.0	3,677	28.0
$10,000-$14,999	162	14.4	1,104	20.9	544	19.0	3,153	20.2	2,349	22.3	3,375	25.7
$15,000-$25,000	96	8.5	428	8.1	263	9.2	1,779	11.4	832	7.9	1,326	10.1
$25,000 and over	10	.9	121	2.3	29	1.0	343	2.2	337	3.2	302	2.3

Source: Bureau of the Census, 1970.

Table 2.1.16.3-20

Total Housing Units

New Mexico, 1970

HOUSING UNITS	Hidalgo	Grant	Luna	Dona Ana	Eddy	Lea	Total
Total units	1,558	6,946	3,923	19,818	15,070	17,158	64,473
Year-round units	1,525	6,942	3,909	19,716	14,937	17,107	64,136
Lacking some or all plumbing facilities	4.1	7.9	6.5	6.2	3.6	1.3	29.6
Vacancy rate							
Homeowner	1.0	2.1	1.6	1.0	5.8	3.6	15.1
Rental	14.5	12.5	9.4	6.1	24.5	17.9	84.9
Median value owner-occupied single family (dollars)	8,119	10,136	10,689	13,527	10,719	11,182	
Median gross rent renter-occupied (dollars)	74	79	70	93	76	79	
Average persons per unit	3.5	3.5	3.3	3.7	3.2	3.3	

Source: Bureau of Census, 1972.

Eddy County also had 2,308 of the total year-round units lacking some or all plumbing facilities. Although at this time there are no data to support this theory, a large portion of the vacant-for-rent units is probably inadequate. Also, since agriculture is the leading industry category, portions of these vacant-for-rent units are occupied only on a seasonal basis.

Inadequate units in the total six-county New Mexico area comprise 29.6 percent of all year-round units for a total of 18,984. This percentage is 24.1 percent higher than the national average and is the most severe in the four states in this analysis.

Median gross rent in 1970 ranged from a high of $93 per month in Dona Ana County to a low of $70 per month in Luna County. The average for the six-county area was $78 monthly.

Availability of lodging for transient workers is critical in New Mexico because the supply of available transient lodging is low.

2.1.16.4 Texas and Midland terminal area

Population

Between 1960 and 1970, the seven Texas counties of El Paso, Hudspeth, Culberson, Ector, Andrews, Martin, and Midland experienced an overall population increase of 40,059 persons. This increase occurred despite the fact that Hudspeth, Andrews, Martin, and Midland counties had a total decrease in population of 6,607 persons. Hudspeth lost over 28 percent of the total population during this 10-year period, and Andrews County lost over 22 percent. The dominance of El Paso County over the total seven-county area is clearly indicated by this data.

A slow turnaround in this population trend occurred between 1970 and 1974. All counties except Culberson reported increases in population although increases were minimal in most counties (Table 2.1.16.3-1). Hudspeth had a 21.2 percent increase which increased the population to 2,900 in 1974.

Low total populations in Hudspeth, Culberson, and Martin counties can be explained by considering that the primary economic bases for those counties are agriculture and wholesale and retail trade establishments.

The growth rate for the entire seven-county area was 10 percent for a total population increase of 53,704. Again, the 50,709 increase in El Paso must be viewed separately when considering the area as a whole.

Table 2.1.16.4-1 shows employment by industry in the Texas counties of El Paso, Hudspeth, Culberson, Ector, Andrews, Martin, and Midland.

The total labor force in this seven-county area was 185,883 in 1970 with a 32 percent increase in 1975, for a total labor force of 246,159 in 1975. The dominance of El Paso, Ector, and Midland counties as a regional labor market is indicated by the fact that in 1975, 96 percent of the total labor force was in the three-county area. Hudspeth had the lowest supply of laborers with a county total of only 843 (Table 2.1.16.4-2).

While total labor force increased 32 percent, total employment increased only 29 percent. This caused unemployment to rise between 1970 and 1975.

Texas minorities

In Texas, with the exception of Midland, most of the minority workers are Spanish surnamed. In Midland, 52 percent of minority workers are black Americans and 46 percent are Spanish surnamed (Table 2.1.16.4-3). The black employment rate for El Paso was 50 percent higher than that of total minorities.

Table 2.1.16.4-1

Employed Population by Industry

Texas, 1970

ECONOMIC SECTORS	El Paso	Hudspeth	Culberson	Ector	Andrews	Martin	Midland
Agriculture, forestry, and fisheries	1,021	275	72	226	65	233	455
Mining	1,360	17	89	5,103	1,258	29	6,311
Construction	6,058	64	186	3,045	161	106	1,211
Manufacturing durable goods	4,810	13	0	1,548	47	5	778
Manufacturing nondurable goods	12,253	0	22	2,593	127	38	753
Transportation	7,821	51	98	2,084	207	73	1,353
Wholesale and retail trade	22,620	136	333	8,831	675	305	4,801
Finance, insurance, and real estate	4,860	0	0	1,356	73	58	1,477
Business and repair services	3,140	25	12	1,670	128	29	1,013
Personal services	4,643	36	131	1,626	151	68	1,965
Entertainment and recreational services	884	0	0	288	39	0	272

Table 2.1.16.4-2

Civilian Labor Force, Employment and Unemployment

Texas, 1970-1975

COUNTIES	Work Force 1970	Work Force 1975	Total Employment 1970	Total Employment 1975	Total Unemployment 1970	Total Unemployment 1975	Percent Unemployed 1970	Percent Unemployed 1975
Texas	4,297,786	5,292,000	4,141,529	4,997,000	156,257	295,000	3.6	5.6
El Paso	112,825	150,302	106,919	136,825	5,906	13,477	5.2	9.0
Hudspeth	834	843	805	810	29	33	3.5	3.9
Culberson	1,292	1,394	1,252	1,340	40	54	3.1	3.9
Ector	37,524	51,321	35,889	49,725	1,653	1,596	4.3	3.1
Andrews	4,217	4,315	4,029	4,198	188	117	4.5	2.7
Martin	1,696	2,079	1,635	2,008	61	71	3.6	3.4
Midland	27,495	35,905	26,521	34,839	974	1,066	3.5	3.0

Source: Bureau of the Census, 1972.

Table 2.1.16.4-3

Texas Minority Labor Force, April, 1976

COUNTY	Labor Force	Employed	Unemployed	Unemployment Rate
El Paso				
Total minority	90,350	80,500	9,850	10.9
Black	3,200	2,700	500	15.6
Spanish	85,950	76,700	9,250	10.8
Other nonwhite	1,200	1,100	100	8.3
Hudspeth				
Total minority	445	425	20	4.5
Black	-[a]	-	-	-
Spanish	435	415	20	4.6
Other nonwhite	-	-	-	-
Culberson				
Total minority	675	640	35	5.2
Black	-	-	-	-
Spanish	675	640	35	5.2
Other nonwhite	-	-	-	-
Winkler				
Total minority	405	385	20	4.9
Black	-	-	-	-
Spanish	315	305	10	3.2
Other nonwhite	-	-	-	-

[a] Data not obtainable.

Table 2.1.16.4-3 (Continued)

COUNTY	Labor Force	Employed	Unemployed	Unemployment Rate
Midland[b]				
Total minority	7,100	6,500	600	8.5
Black	3,720	3,380	340	9.1
Spanish	3,250	2,990	260	8.0
Other nonwhite	130	130	-	-
Ector[b]				
Total minority	8,210	7,810	400	4.9
Black	2,610	2,470	140	5.4
Spanish	5,480	5,230	250	4.6
Other nonwhite	120	110	10	8.3

[b] Data for Midland and Ector counties is for July, 1976.

The wholesale and retail trade are the major employers in the counties along the proposed pipeline route in Texas, and employed over 20 percent of the labor force in El Paso, Culberson, Ector, and Martin counties.

The mining industry in Midland and Andrews counties utilizes approximately 33 percent of the total labor force in those two counties. With the exception of the professional and related services sector, which employs an average of 15 percent of the labor force in each county, the labor force is distributed almost equally throughout the remaining classifications.

Since recreation and relaxation are important activities during nonworking hours, it should be noted that Hudspeth, Culberson, and Martin counties report none of the labor force employed in the entertainment and

recreational service categories although leisure outlets are presumed to be available.

Since major pipeline construction will occur between Jal, New Mexico, and Midland, Texas, the availability of construction workers, operatives, transport operatives, and laborers is essential. In 1970, the total labor force in these four categories was 51,497, with the largest number of employees in El Paso County. Even with the low unemployment rates in all counties except El Paso, a shortage of workers in these categories is not expected in relation to the construction needs of the proposed pipeline in this area.

Housing. The availability of housing for construction workers in areas where they will be employed in pipeline construction is especially critical to the Texas areas since this construction will occur between Jal, New Mexico, and Midland, Texas, with a major terminal being constructed in Midland. Although much of the Midland terminal work force is expected to be locally resident, the outlying construction areas will require transient housing.

The seven Texas counties had a total of 162,034 housing units in 1970. Of this total, 161,721 were for year-round occupancy.

Owner-occupied units comprised an average of 64.5 percent of year-round units. This is approximately 104,310 which were owner-occupied, and 57,411 which were renter-occupied in the seven-county area. Midland County had a 73.8 percent owner-occupied rate which usually indicates a shortage of rental units.

Vacant-for-sale data were not critical in the major construction site in California nor will they be in Texas.

Construction work in Texas will require a large number of workers for a maximum of six months. Again, maintenance station personnel will probably be drawn from the local labor pool.

Vacant-for-rent units in the seven Texas counties totalled approximately 16,080, or 9 percent, of the total year-round units. However, in view of the fact that between 1970 and 1974 this same seven-county area had a population increase of 53,704, and 37.7 percent (or 60,968 units) of the year-round housing lacked some or all plumbing facilities, rental unit availability is most likely very low.

Income. Table 2.1.16.4-4 indicates that the seven counties along the pipeline corridor in Texas had a total increase in mean per capita personal income of $1,973 between 1969 and 1973. Martin County experienced a 265 percent increase, the largest increase in the seven-county area. (This increase is not detailed here due to unavailability of data at the time of this writing.)

Table 2.1.16.4-4

Per Capita Personal Income

Texas

COUNTIES	1969	1969[a]	1972	1972[a]	1973	1973[a]
El Paso	$2,968	$3,143	$3,611	$3,352	$3,932	$3,436
Hudspeth	2,775	2,939	4,846	4,498	5,103	4,459
Culberson	3,023	3,202	3,096	2,874	3,422	2,990
Ector	3,243	3,435	3,734	3,466	4,180	3,652
Andrews	3,462	3,667	3,346	3,106	3,922	3,427
Martin	2,918	3,090	5,241	4,865	10,662	9,316
Midland	4,196	4,444	4,714	4,375	5,172	4,519

Source: U.S. Department of Commerce, 1975.

[a] 1970 constant dollars

Hudspeth also had the second largest increase with an 83 percent in per capita personal income.

Approximately 24 percent have family incomes of less than $5,000. Hudspeth and Martin counties had 46 and 40 percent, respectively, of their families in the $5,000-and-under grouping. As was true with Arizona and California, the remaining five counties had the largest portion of their families in the $7,000 to $15,000 income range.

In 1970 the average median income was $8,004 for the seven Texas counties. With the state average at $8,486, this area was $482 below the state. Midland County was above the average of the seven counties with a median family income of $10,444.

Of the 81,771 families in El Paso County, 14,228 (17.4 percent) had incomes below poverty level in 1970. A total of 19,194 families had incomes below poverty level, with Hudspeth and Martin counties having the largest percent of families in this category.

2.1.16.5 Energy supply and demand (Federal Energy Administration, 1976)

Petroleum

The following material beginning on this page and ending on page 929 is taken from The 1976 National Energy Outlook, published by the Federal Energy Administration (FEA), 1976.

The outlook for domestic oil supply is clouded with uncertainty. The extent and availability of domestic resources, Federal Outer Continental Shelf (OCS) leasing policy, form and duration of oil price controls, success of tertiary recovery techniques, and participation of state and local governments will determine future production possibilities.

In recent years, significant changes have occurred in domestic crude oil production, reserves, imports, prices, and consumption. This section discusses the present oil supply situation, the events leading up to it, and the short-term, supply-and-demand outlook.

The present situation

The present oil supply situation is best characterized by the following:

1. The United States now imports almost 40 percent of the oil it consumes.

2. Price controls on domestic production have been in effect since 1973.

3. Proved reserves have been steadily declining since 1970 (although nearly 10 billion barrels were added to proved reserves in north Alaska in 1970, no oil has yet been produced).

4. Domestic production levels have been decreasing since 1970, but may be beginning to fall more slowly.

5. Federal leasing of the outer continental shelf (OCS) areas has been stepped up.

6. Drilling effort for oil has been increasing since 1972 after declining for 15 years.

7. Domestic oil consumption has declined from 1973 levels.

The relevant historical perspective behind these observations can be divided into two parts; the dividing point is the Arab oil embargo of 1973.

Pre-embargo period

Three major factors shaped domestic oil supply from the 1950s to the early 1970s:

1. Crude oil prices remained relatively flat (actually declining when adjusted for inflation). See Figure 2.1.16.5-1.

2. Conservation practices in major producing states held crude oil production well below full capacity until about 1970.

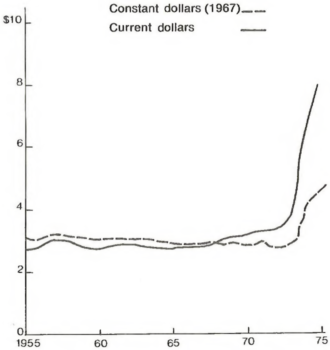
3. A large amount of cheap foreign crude oil overshadowed the world petroleum market; its import into the United States, however, was limited severely by mandatory oil import quotas.

These factors created a preembargo domestic oil supply situation with a number of important features:

1. Oil drilling declined steadily after 1959 for two major reasons (Figure 2.1.16.5-2): (1) decreased profitability of domestic production in mature producing areas (because of rising costs and flat oil prices in the face of cheap foreign oil); and (2) the lack of access to Federal lands in frontier areas (OCS and Alaska).

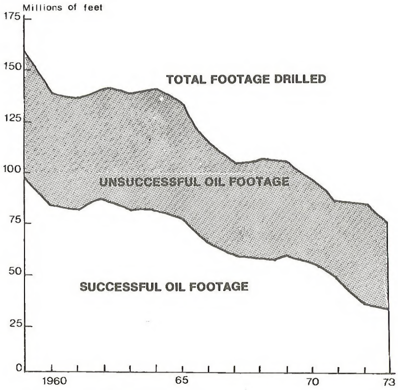
2. In response to decreased drilling, domestic oil reserves declined steadily after 1966 (except for Alaskan reserves added in 1970; Figure 2.1.16.5-3).

3. Until 1970, production increased, at which point full capacity was reached. After the 1970 peak, domestic production began to follow reserves downward (Figure 2.1.16.5-4).



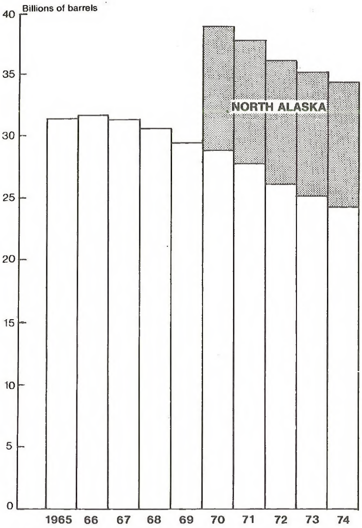
Source: U.S. Bureau of Mines, U.S. Bureau of Labor Statistics, American Petroleum Institute and Federal Energy Administration

Figure 2.1.16.5-1 Average wellhead price of U.S. crude 1955-75



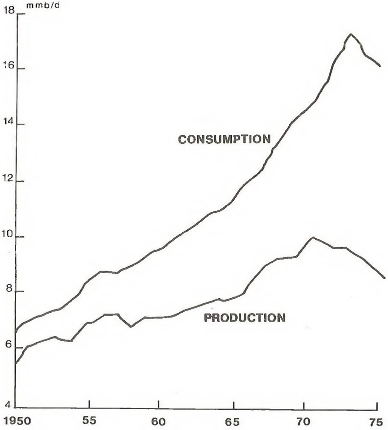
Source: American Petroleum Institute

Figure 2.1.16.5-2 Oil drilling trends 1959-73



Source: American Petroleum Institute

Figure 2.1.16.5-3 U.S. proved reserves of crude oil 1965-74



Source: U.S. Bureau of Mines

Figure 2.1.16.5-4 U.S. petroleum production and consumption 1950-75

4. Meanwhile, domestic oil consumption increased steadily in the face of this production trend, reaching a preembargo peak in 1973 of more than 17 million bbl/d (Figure 2.1.16.5-4).

5. In turn, the widening gap between domestic oil consumption and domestic production was filled with increasing quantities of cheap oil imports (Figure 2.1.16.5-5).

6. These growing United States imports soon caused western hemisphere sources to reach their production capacities. Afterward, the importance of the western hemisphere began to decline as an increasing percentage of imports came from the eastern hemisphere (Figure 2.1.16.5-6).

7. Finally, the makeup of the imports shifted from crude to products as a by-product of import quota exemptions in PADD-I, environmental requirements for low-sulfur fuel oil, and various incentives embedded in price controls (Figure 2.1.16.5-7).

Post-embargo period

The changes in the oil supply situation caused by the 1973 Arab oil embargo caused a rethinking of the entire domestic energy situation.

After 1973, imports became expensive -- up to $12 a barrel, excluding any import fees, and domestic crude oil prices increased from around $3 to more than $8 nominally and to nearly $5 in constant dollars (Figure 2.1.16.5-1).

These factors have been the major determinants of the oil supply situation in 1974 and 1975:

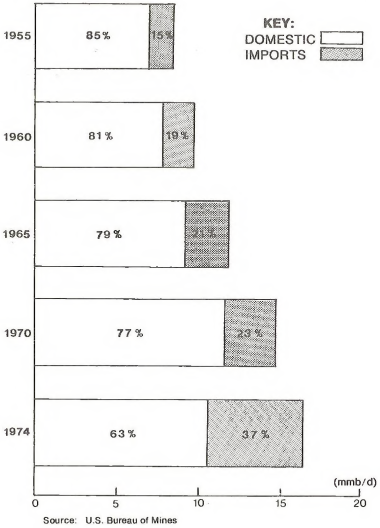


Figure 2.1.16.5-5 U.S. oil consumption by source 1955-74

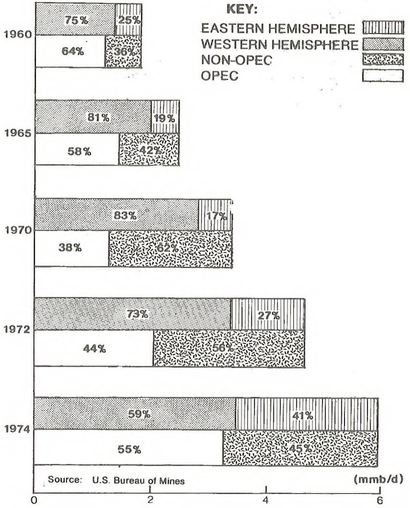
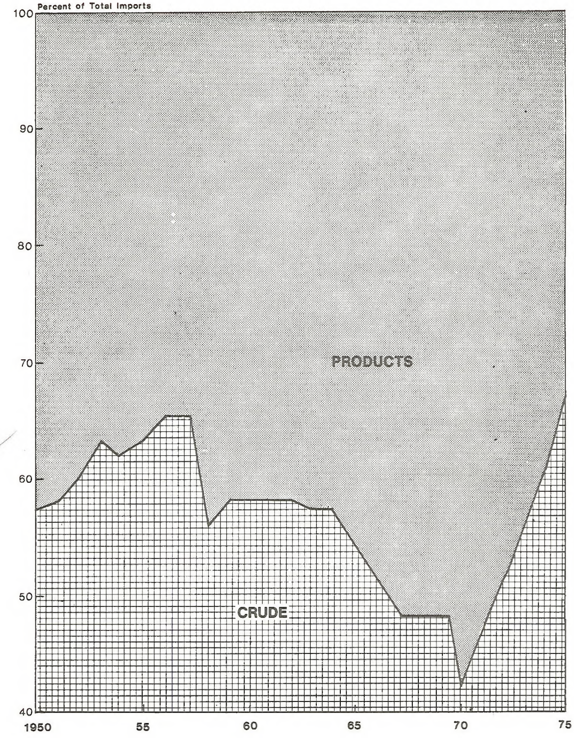


Figure 2.1.16.5-6 Total U.S. petroleum imports by regional and organizational sources 1960-74



Source: U.S. Bureau of Mines

Figure 2.1.16.5-7 Petroleum Imports 1950-75

1. Although price controls remained in effect for "old" oil, "new" oil was sold at the wellhead at a free market price. This changed under the Energy Policy and Conservation Act (EPCA) of 1975.

2. For the first time in recent history, domestic demand declined, from a high in 1973 of about 17.3 million bbl/d, to a 1975 figure of approximately 16.2 million bbl/d (Figure 2.1.16.5-4).

3. Drilling activities for oil increased dramatically in 1974 and 1975; the active rotary rig count in 1975 reached 1,877, the highest count since 1962.

4. Federal leasing activity on the outer continental shelf increased.

5. Higher prices stimulated consideration of tertiary processes to increase crude oil recovery.

6. Domestic crude oil production decline began to slow in 1975.

Effects of the Energy Policy and Conservation Act of 1975

The short-term outlook for supply and demand for crude oil in the United States is in transition. The precise course of near-term consumption and production is uncertain, because the effects will be closely related to final implementation of the EPCA. Domestic consumption will increase in the short-term regardless of the EPCA as the economy recovers. However, the lowering of crude oil prices under the EPCA will increase demand even further. Because production will remain relatively level in 1977 and 1978, imports would have reached 8.0 million bbl/d in this period had several conservation measures not been in effect. The impact of these measures will be to reduce expected imports to between 6.0 and 7.0 million bbl/d in 1977-1978. Uncertainties remain with respect to inclusion of Alaskan production

in the calculation of the average price, the future levels of the production incentive factor, and the final effect of the program on petroleum industry decision making.

Business-as-usual supply outlook

The future oil supply outlook is estimated for a range of geological assessments and under different policy assumptions. This range of outlooks is indicated by three supply forecasts, entitled: pessimistic, business-as-usual (BAU), and optimistic. These represent three points on a spectrum of potential future oil supply levels.

Equally important, these forecasts represent supply "possibilities," in light of the assumptions underlying each outlook and different import prices of crude oil and its coproducts (associated-dissolved gas and natural gas liquids). These "possibilities" are converted into an estimate of actual production by the overall Project Independence Evaluation System (PIES), after consideration of the demand for crude and its coproducts as well as of the major costs incurred to convert crude to products useful to energy consumers (e.g., transportation, refining, distribution, etc.).

Among these three outlooks, the forecast resulting from the BAU outlook is the central one. From an oil supply perspective, this outlook reflects the U.S. Geological Survey (USGS) geological assessment which USGS believes has a 50-50 chance of proving-out in actual practice over time. (This resource outlook is referred to as the "statistical mean" in USGS Circular 725, from which the supply possibilities described are derived.) The BAU outlook assumes that: (1) OCS leasing proceeds according to the announced leasing schedule; (2) tertiary oil recovery methods prove successful technically and economically and are applied at a moderately optimistic pace; (3) oil and gas deregulation occurs over the next few years; and (4) the present provisions of the Federal tax code which affect crude oil economics remain unchanged.

Oil supply estimates are made primarily on the basis of a set of assumptions which are considered most likely. The assumptions that make up the BAU supply possibility outlook are summarized in Table 2.1.16.5-1. These assumptions and the uncertainty surrounding them are discussed in subsequent sections of this chapter

Table 2.1.16.5-1

Business-as-Usual Supply Outlook Assumptions

RESOURCE ESTIMATES	USGS Statistical Mean
OCS leasing (1975-1984)	26.8 million acres
Investment tax credit	10% through 1977; 7% thereafter
Alaskan pipeline capacity	2.0 MMbbl/d in 1980; 2.5 MMbbl/d in 1985
Price controls	Removed within a few years
Tertiary recovery	Tertiary methods prove out, but are applied at a moderate pace

Source: FEA, 1976.

The Optimistic and Pessimistic outlooks differ from BAU with respect to level of geological success, the rate of leasing offshore, the degree of success and pace of application of tertiary oil recovery, and the fate of the investment tax credit. The specific assumptions underlying each supply outlook are detailed in a later section.

Business-as-usual supply possibilities

The $13 BAU supply trajectory

Domestic production is quoted at the world oil price (in constant 1975 dollars) with which it competes. When these supply possibilities mesh with the consumption input to the main PIES, the actual wellhead price of domestic production would be less than the competitive imported oil price, the difference lying mainly in the transportation cost from wellhead to refinery.

Under any one oil supply outlook (e.g., BAU), future oil supply possibilities vary over time between geographical areas, between the portion of the overall resource base from which they may be withdrawn (e.g., newly discovered fields versus known fields), and between the mix of recovery technology employed (e.g., primary, secondary and tertiary methods). Along each of these dimensions the quantities in any future year also vary with the prices of crude and coproducts that the producing industry expects will prevail. At $13 and under BAU conditions, observations emerge concerning the makeup of future oil supply possibilities (Table 2.1.16.5-2 shows the BAU supply possibilities estimated to be available if the industry expects $13 per barrel import prices [in constant 1975 dollars] and identical prices, on a British thermal unit [Btu] equivalent basis, for the crude and its coproducts):

1. The main source of today's domestic crude production (Lower-48 [continental U.S.] onshore initial reserves) will shrink by two-thirds by 1985 and by 80 percent by 1989. Before crude production on the Lower-48 can expand, the withdrawals which account for this decline must be replaced.

2. Sufficient new Lower-48 onshore production can become available to approximately sustain 1976 production rate through 1985.

Table 2.1.16.5-2

BAU Oil Production Possibilities at $13[a]

LOCATION/SOURCE	Million Barrels per Day 1975	1980	1985	1989
Lower-48 onshore				
New field primary/secondary		0.8	1.9	2.2
Old field secondary		2.0	2.0	1.8
Tertiary		0.5	1.0	1.3
Initial reserves	7.0	4.2	2.4	1.5
Subtotal	7.0	7.5	7.3	6.8
Lower-48 OCS				
Pacific	0.2	0.6	0.6	0.5
Gulf of Mexico	1.0	1.4	1.4	1.1
Atlantic		0.1	0.1	0.1
Subtotal	1.2	2.1	2.1	1.7
Alaska				
Beaufort Sea			0.4	0.8
Other OCS	0.2	0.3	0.4	0.4
North Slope		1.7	2.3	1.7
NPR-4				
Subtotal	0.2	2.0	3.1	2.9
Other				
NPR-1[b]		0.2	0.2	0.2
Tar sands				
Heavy hydrocarbons		0.1	0.2	0.3
Subtotal		0.3	0.4	0.5
Total crude	8.4	11.9	12.9	11.9
Natural gas liquids[c]	1.6	1.9	1.8	1.8
Total liquids	10.0	13.8	14.7	13.7

Source: FEA, 1976

[a] Throughout this section, domestic production is presented as a supply possibility at a given equivalent imported oil price.

[b] Navy Petroleum Reserve-1 (Elk Hills).

[c] Excludes natural gas liquids produced at refineries.

Through 1980, withdrawals from today's proved reserves will be replaced mainly by fluid injection projects, extensions, and revisions applicable to known fields (labeled old field secondary in Table 2.1.16.5-2). By 1985, however, new fields and more elaborate tertiary recovery technology must replace the further decline in production from existing onshore reserves. This replacement is estimated to occur as follows: 40 percent from new fields, 40 percent from technically straightforward expansion of the production capacity of known fields, and 20 percent from tertiary recovery. After 1985, production from new fields and tertiary recovery must accelerate in order to counter the dwindling potential of primary recovery methods in old fields.

Since the Lower-48 onshore can just offset further decline at $13 and under BAU conditions, growth in total domestic oil supply at $13 must come from less mature provinces. Two areas, the Lower-48 OCS and Alaska (onshore and offshore), are expected to provide growth. Of the two, Alaska has the greater potential.

1. In 1985 under BAU assumptions, potential Alaskan crude production is estimated to equal 3.1 million bbl/d, or about one-fourth of total domestic production (Table 2.1.16.5-2).

2. Of this, at least 1.6 million bbl/d (from reserves already proved at Prudhoe Bay) is reasonably well assured. The balance -- 0.8 million bbl/d from other North Slope regions -- depends upon reasonable geological fortune, new technology, and substantial institutional effort.

Without more accelerated effort in Alaska and successful results from additional oil search, continued withdrawal of today's proved reserves on the North Slope will cause Alaskan production to decline slightly between 1985 and 1989.

The Lower-48 OCS is the second most important area for expanding domestic production. Assuming that the BAU leasing schedule is achieved and the geological potential of the OCS has been assessed correctly, Lower-48 OCS production can almost double by 1985. If so, this area will account for 16 percent of total crude production that year (Table 2.1.16.5-3). The assumed rate of leasing limits the Lower-48 OCS production estimate over the period of the BAU outlook. Consequently, an inadequate leasing rate can cause a decline in Lower-48 OCS production after 1985. Similar to onshore, OCS production growth must follow after replacement of withdrawals from 1976 OCS reserves -- principally in the Gulf of Mexico. For example, the net increase of 0.4 million bbl/d in the Gulf of Mexico by 1985 requires gross additions of productive capacity of 1.1 million bbl/d. By 1985 the remainder of the Lower-48 OCS increase (0.5 million bbl/d) should come from the Atlantic and Pacific.

The remainder of any increase in crude production is envisioned to stem from NPR-1 and heavy hydrocarbons. Both make a contribution to future supply, but one that should be dwarfed by Alaska, the Lower-48 OCS, and by replacement to 1976 productive capacity on the Lower-48 onshore.

Finally, the remainder of total conventional petroleum liquids available domestically is expected to consist of coproducts of crude production (liquid derivatives of associated-dissolved gas) and of nonassociated gas. The additional liquids are expected to account for about 12 percent of total production (Table 2.1.16.5.-3).

Effects of price on BAU supply

The overall level of BAU oil supply possibilities changes substantially if price expectations are higher or lower than $13 (Table 2.1.16.5-3). This change is the result of different price effects in various geographical areas, different components of the resource base, the rate of drilling and changes between alternative oil recovery methods.

Table 2.1.16.5-3

1985 BAU Oil Production at Alternative Import Prices[a]

SOURCE	Million Barrels per Day $8	$13	$16
Lower-48, onshore	4.4	7.3	7.7
Lower-48, OCS	1.9	2.1	2.3
Subtotal	6.3	9.4	10.0
Alaska	2.3	3.1	3.1
Other	0.4	0.4	0.6
Total crude	9.0	12.9	13.7
Natural gas liquids	1.1	1.8	2.4
Total liquids	10.1	14.7	16.1

Source: FEA, 1976

[a] Production at expected oil price.

In 1985, the potential response of oil supply to price is projected as follows (Figure 2.1.16.5-8):

1. Between $8 and $13, the estimated crude supply response is large -- 4.0 million bbl/d by 1985.

2. Through 1980, time lags are estimated to make the response smaller (1.6 million bbl/d). By 1985 major time delays should be resolved; thereafter continuing decline in the quality of resources found causes the difference between $8 and $13 to grow further (to 5.3 million bbl/d in 1989).

The largest share (75 percent) of the 4.0 million bbl/d growth in response to price by 1985 occurs onshore in the Lower-48. In these onshore areas, the supply response from $8 to $13 stems from new fields and from more sophisticated tertiary recovery methods.

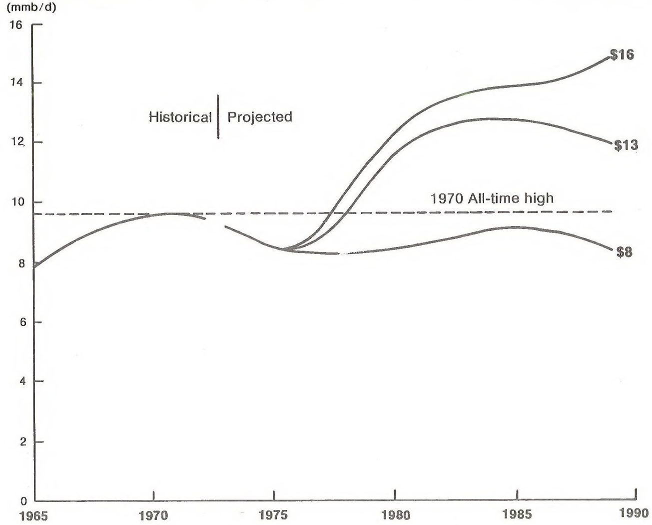


Figure 2.1.16.5-8 Crude oil production at three prices (BAU) 1965-90

1. The 2.9 million bbl/d price response onshore in the Lower-48 is made up of 2.0 million bbl/d from new fields, primary and secondary, and 1.0 million bbl/d from tertiary recovery.

2. This indicates that replacing 1976 productive capacity in the Lower-48 by 1985, and to an even greater extent beyond 1985, depends on the more expensive components of potential future supply.

The next most important contributions to the supply response between $8 and $13 are Alaska (20 percent) and the Lower-48 OCS (5 percent).

The components of future supply which are price insensitive by 1985 can be interpreted as follows:

1. The assumed rate of leasing constrains the estimate from the Lower-48 OCS through 1985 (and, generally, through 1989 also).

2. This suggests that the result of less leasing is a greater reliance on higher-priced foreign supply sources in lieu of lower cost domestic resources offshore.

3. In the case of tertiary recovery, price insensitivity above $12 is a function of the pace of technical development as well as the rate of application of new technology in the field. This conservation represents a judgment in response to the speculative nature of tertiary recovery technology.

4. In the case of Alaska, the mild price response reflects the joint effects of leasing rates and pipeline capacity constraints. The supply response in later years, however, could be greater.

Other implications of constraints other than price are (1) careful scrutiny is needed to ensure that an unrealistically conservative estimating bias does not exist, (2) relieving supply bottlenecks of both a physical and institutional nature may become a more important and cost-effective policy as prices rise.

Reserves and resources

An assumption underlying the analysis of oil production estimates is the assessment of the resources, both discovered and undiscovered, from which production must ultimately come. Resources assessments fall into the categories of proved reserves, indicated and inferred reserves, and undiscovered recoverable resources. Each of these categories will be discussed, followed by a description of its use in the Federal Energy Administration (FEA) oil supply model.

Proved reserves

Past estimates of U.S. petroleum reserves have been characterized by a high degree of uncertainty resulting in a broad range of estimates, none of which could be considered definitive. Recognizing that a key element in formulating a national energy policy is the development of a reliable estimate of remaining domestic crude oil and natural gas reserves, the Federal Energy Administration Act of 1974 required FEA to prepare a ". . .complete and independent analysis of actual oil and gas reserves and resources in the United States and its Outer Continental Shelf. . . ." The FEA report on reserves was submitted to the Congress in October, 1975. The FEA survey of reserves estimated that proved oil reserves were 38 billion barrels, with most of the potential in Texas, Alaska, California, and Louisiana.

This contrasts with an assessment by the USGS which, using data supplied by the American Petroleum Institute (API), estimated United States crude oil

reserves at 34 billion barrels. Even though proved reserves is the category of resources about which the most is known, some differences still exist between the two estimates, which are even further magnified in trying to assess correctly the entire resource base.

These proved reserves of crude oil represent the most definitive source for future production, but as they are drawn down by production, the reserve pool must be supplemented by other categories of resources in order for production not to continually decline. It is proving these other resource categories that will supply future production.

Indicated and inferred resources

Indicated reserves are those reserves as yet unproved but believed recoverable from known fields using known fluid injection techniques. According to the USGS Circular 725, they amount to 4.7 billion barrels. Inferred reserves are those inferred from demonstrated reserves (measured plus indicated) and are, therefore, more speculative. Circular 725 has inferred reserves amounting to 23 billion barrels. These additions are due to extensions, revisions, and new horizons within the defined limit of an oil field.

Undiscovered resources

The USGS also reports assessments of undiscovered recoverable resources based on historical and geological data. To emphasize the uncertainty involved with these assessments, they are reported not as point estimates, but rather as a range of quantities and probabilities. The statistical mean of the range of quantities is the USGS estimated point where there is a 50-50 chance of the actual amount being above or below that quantity. The 95 percent point is the USGS estimate that there is a 95 percent chance that there is at least this amount, and the 5 percent point is where there is only a 5 percent chance that there is at least this amount. As an example

of this technique, the USGS estimate for economically recoverable oil resources in the United States has a statistical mean of 89 billion barrels, a 95 percent point of 50 billion barrels, and a 5 percent point of 127 billion barrels (Table 2.1.16.5-4).

Table 2.1.16.5-4

Reserves and Undiscovered Resources
(Billions of Barrels)

REGION	Reserves: Demonstrated: Measured	Reserves: Demonstrated: Indicated	Reserves: Inferred	Resources: Undiscovered Recoverable: Statistical Mean	Resources: Undiscovered Recoverable: 95%-5% Range
Economic resources[a]					
Lower-48 onshore	21.1	4.3	14.2	44	29-64
Lower-48 offshore	3.1	0.4	2.6	18[b]	11-28
Alaska offshore	0.2	0	0.1	15	3-31
Alaska onshore	9.9	negligible	6.1	12	6-19
Total	34.3	4.7	23.0	89	50-127
(Subeconomic)	(120)	(negligible)	(20)	(57)	(44-111)

Source: USGS Circular 725.

[a] Economic at pre-embargo prices.

[b] Adjusted for resources at water depths greater than 660 feet (200 meters).

Resource assessments in the estimation process

Crucial to the modeling effort for projecting future oil production is the capability of the model to "capture" the entire range of the resource base. USGS Circular 725 delineates the resource base in the various categories (Figure 2.1.16.5-9).

The FEA oil supply model performs six production calculations for each expected price in each region during each year. These six "types" of

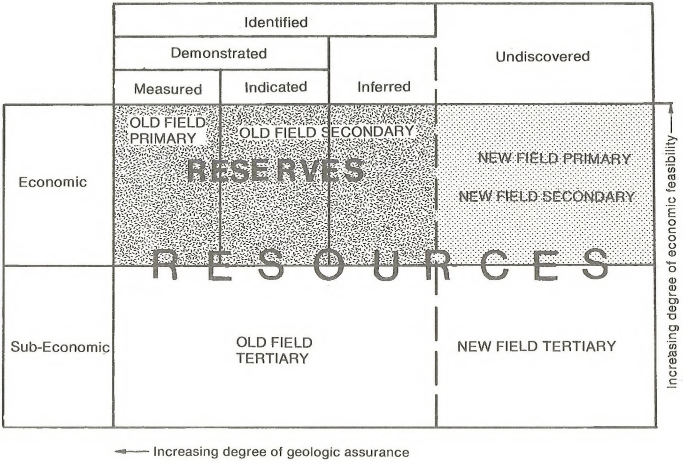


Figure 2.1.16.5-9 Petroleum resources of the United States

production correspond to the resource categories into which the domestic resource base is divided by the USGS. The labels the model uses to designate production from each of these categories are also shown in Figure 2.1.16.5-9.

Several observations emerge regarding reserve and resource assessments (Table 2.1.16.5-4):

1. Using the USGS "statistical mean" for undiscovered resources, 151 billion barrels of "undiscovered" and "identified" (demonstrated plus inferred) resources remain economically recoverable. Another 197 billion barrels potential (classified as subeconomic) might ultimately become recoverable at prices above preembargo levels with new technology and time. Both amounts compare to cumulative domestic oil production to date of about 105 billion barrels.

2. Of these potential resources, the indicated and inferred portions (which are considered to be more nearly assured) are large. Ultimately, 80 percent of the withdrawals from 1976 proved or "measured" reserves might be replaced from these two categories.

3. The uncertainty associated with undiscovered recoverable resources is large (indicated by the wide spread of the 95 to 5 percent range). The quantity represented by this range amounts to plus or minus more than 40 percent of the 89 billion barrels which have a 50-50 chance of being discovered and recovered. As will be shown later, this resource uncertainty causes future production estimates to be equally uncertain.

4. More than half of the 89 billion barrels of the statistical mean of undiscovered recoverable resources reside in immature regions with little or no production or cost history (Alaska and

offshore). This fact further increases the uncertainty of oil supply projections.

5. The quantity of resources which the USGS considers "subeconomic" at preembargo prices is very large -- 197 billion barrels. Higher prices, new technology, and time may make a substantial portion of this resource attractive for production. This fact complicates the problem of estimating future oil supplies, especially at prices substantially above preembargo levels.

The adequacy of the resource base to provide projected reserve levels is illustrated by the quantities of resources that must be proved as reserves to achieve the BAU forecasts at different prices during the 15-year time span of the projections (Table 2.1.16.5-5). The quantities are derived from results of the oil supply model. Several points concerning the adequacy of the resource base to provide projected reserve levels are important:

1. In order to capture the production from inferred reserves, the "secondary recovery from old fields" production category has been expanded to include all production from the economic portions of both indicated and inferred reserves. This includes primary production from inferred reserves. Tertiary production from old fields is considered subeconomic at preembargo prices, and stems from the subeconomic reserve category.

2. At $13, about 55 percent of the total of 48.9 billion barrels of reserves added is through primary and secondary development of new fields (discovered subsequent to 1 January 1975).

3. A little less than one-third more comes from secondary development of old fields (the definition of which has been enlarged to include inferred reserves).

4. The final sixth of the reserves added results from development of tertiary recovery processes that were subeconomic at preembargo prices.

5. At $16, less than half of the economically recoverable resources available are proved as reserves, about 21 percent or the total resources available (both economic and subeconomic).

6. Tertiary reserves, which are derived from a resource category of potentially enormous size (177 billion barrels), has reached only a very low level by 1989 (10.9 billion barrels).

The results of the 15-year projections depend upon the resource base assumptions and also on the effort required to convert resources into reserves and subsequently to produce them.

Table 2.1.16.5-5

BAU Proved Reserves Added, 1975-1989
(Billions of Barrels)

RESOURCE	USGS-725 Mean	Expected Oil Price $8 bbl	$8 %	$13 bbl	$13 %	$16 bbl	$16 %
USGS "economic"							
New field primary and secondary	73.6[a]	10.8	14	26.7	35	32.0	43
Old field secondary	21.5	14.4	67	14.4	67	14.4	67
Subtotal	98.1	27.2	28	41.1	42	46.4	47
USGS "subeconomic"							
New field tertiary	57.0	0.0		0.3		0.7	
Old field tertiary	120.0	0.6		7.5		10.2	
Subtotal	177.0	0.6		7.8		10.9	
Total	275.1	27.8		48.9		57.3	

Source: FEA, 1976.

[a] Alaska onshore and Beaufort Sea excluded. Lower-48 OCS adjusted for resources at water depths greater than 660 feet (200 meters).

OCS leasing

During 1974, 1.8 million acres of OCS lands were leased, or about 26 percent of the total of 6.8 million acres leased between 1964 and 1974. The assumed business-as-usual OCS leasing will amount to 34.4 million acres between 1975 and 1989 (Table 2.1.16.5-6).

Table 2.1.16.5-6

Business-as-Usual Leasing

PERIOD	Total[a]	% of Total	Alaska[a,b]	California[a]	Gulf of Mexico[a]	Atlantic[a]
1975-79	15.8	46	4.5	3.1	4.1	4.2
1980-84	11.0	32	2.6	0.9	4.6	2.9
1985-89	7.6	22	2.0	0.6	2.8	2.2
Total	34.4	100	9.1	4.6	11.5	9.3
Percent of Total			26%	13%	33%	27%

Source: FEA, 1976.

[a] In million acres.

[b] Excludes Beaufort Sea.

The schedules were based on assumptions concerning lease sales and the attractiveness of the areas offered to the industry. These assumptions include:

1. There will be six sales per year through 1990.

2. 800,000 acres will be offered in each sale.

3. The percentage of acres leased of those offered in each sale will be 1976 and 1977, 75 percent; 1978 through 1982, 55 percent; 1982 through 1989, 35 percent.

The rationale for the higher percentage leased figure in the early years is based on the fact that the early nominations of acreage will be those with the most attractive structures.

Several points are important:

1. The percentage of acreage-leased assumption leads to nearly half of the acreage to be leased in the first five years.

2. The acreage leased in the 15-year period is divided almost equally between mature and frontier areas; i.e., 46 percent in California and the Gulf of Mexico, and 54 percent in Alaska and Atlantic areas.

3. The lead time between acres leased and production is long; consequently, the effects of the increased leasing in the early years is not felt until much later.

4. The number of sales per year and percentage of acres leased may be optimistic in light of recent experience.

Drilling capacity

Annual drilling rates respond to many factors, including:

1. Industry expectations of oil price and its translation into demand for drilling equipment.

2. Present supply of drilling rigs and their expected usage over time.

3. Current rig-manufacturing capability.

4. Capability of the rig-producing industry to expand capacity over time.

Some points concerning the BAU drilling profiles are important:

1. Drilling at $8 oil prices will be much lower than at higher prices since little onshore oil from new fields is economic at $8 (see Figure 2.1.16.5-10). The bulk of the drilling in the first five-year period (1975-1979) is utilization of existing rigs, and in the latter years, drilling is exclusively offshore.

2. The increase in drilling activities between $8 and $13 reflects the fact that the Lower-48 onshore regions have a large amount of undiscovered oil that is economic only at prices above $8.

3. In the preceding 15-year period (1959-1973), drilling activities for oil declined steadily from more than 150 million feet to a low of 75 million feet per year. The $13 drilling trajectory reverses that decline and peaks in 1985 at nearly 160 million feet. Drilling activities for oil at $13 in the period 1975 to 1989 are expected to average about 120 million feet per year, compared to a yearly average in the preceding 15 years of about 108 million feet.

4. At an expected oil price of $16, drilling is constrained early by rig availability. The greatest production response at $16 occurs later in the forecast as $13 opportunities decline.

<u>Enhanced recovery</u>

Any discussion of enhanced oil recovery first requires a clarification of the terms involved, because of the current differences regarding definitions. For the purpose of this report, the following apply:

Secondary recovery: Water flooding and nonmiscible gas injection, including pressure maintenance

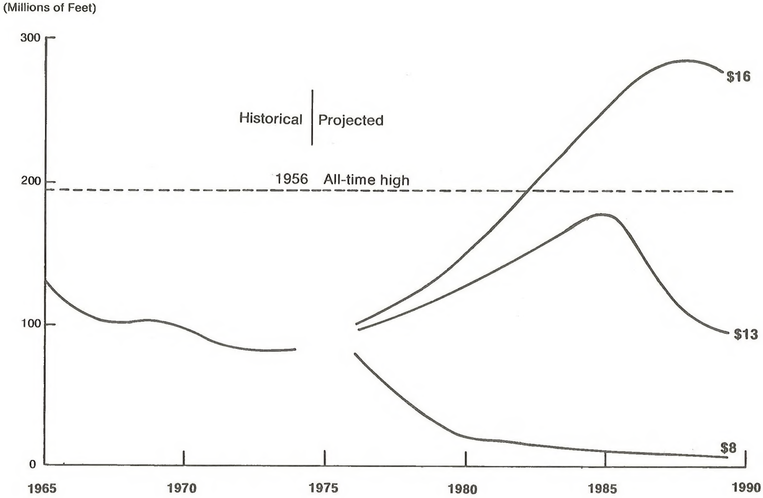


Figure 2.1.16.5-10 Drilling activities for oil (BAU) 1965-90

Tertiary recovery: All thermal techniques, including: cyclic steam injection (steam soak, "huff & puff"); Steam drive; in situ combustion.

Improved water or gas drives: surfactant (miceller slug, caustic, etc.); miscible (carbon dioxide, high pressure gas, etc.); polymer.

Enhanced recovery projects generally are initiated while the field is still producing under primary drive. Thus, while approximately 50 percent of U.S. production, or 4.25 million bbl/d, is currently being produced from fields under enhanced recovery, only about 25 percent (slightly more than 2 million bbl/d) is attributable incrementally to the enhanced recovery projects. In FEA forecasts, only the incremental amount of oil produced from a field under enhanced recovery is that directly attributable to the technique.

From examination of Table 2.1.16.5-7, three conclusions may be drawn:

1. Enhanced recovery production rises to approximately 26 to 30 percent of total crude production (a slight increase over the present 25 percent).

2. The bulk of enhanced recovery production remains secondary methods: These are generally feasible in old fields at prices below the $8 level.

3. Tertiary methods show a large price response between $8 and $13. Above $13, tertiary production in 1985 is constrained by lags in research, planning and commercialization, not prices.

Table 2.1.16.5-7

1985 BAU Production From Enhanced Recovery at

Alternative Oil Prices

TYPE RECOVERY	Crude Oil Price		
	$8	$13	$16
Secondary (MMbbl/d)			
Old fields[a]	2.2	2.2	2.2
New fields	0.4	0.4	0.4
Subtotal	2.6	2.6	2.6
Tertiary (MMbbl/d)			
Old fields	0.1	0.9	0.9
New fields	negligible	negligible	negligible
Subtotal	0.1	1.0	1.0
Total enhanced (MMbbl/d)	2.7	3.6	3.6
Total crude production (MMbbl/d)	9.0	12.9	13.7
% Enhanced of total	30%	28%	26%

Source: FEA, 1976.

[a] Also contains production from inferred reserves.

Increased tertiary production is expected to be largely the result of steam or CO_2 injection which, of all the tertiary techniques, are best understood and provide the fastest response. This outlook, however, remains speculative due to the dearth of data and the range of theories concerning tertiary recovery potential.

Available data suggest that near-term production rates (1980) from tertiary recovery cannot be increased by increasing the expected oil price (Table 2.1.16.5-8). The reason for short-term production constraints is that tertiary recovery is essentially in the research and planning stage as a commercial recovery technique.

Table 2.1.16.5-8

Potential Tertiary Reserve Additions and Production

MARGINAL OIL PRICE	Incremental Reserves Added (Billions of Barrels)	Total Tertiary Production (Million Barrels per Day)		
		1980	1985	1989
$ 8	0.6	0.1	0.1	0.1
10	3.4	0.4	0.6	0.5
12	3.9	0.4	0.9	1.3
14	3.1	0.4	0.9	1.9

Source: FEA, 1976.

Several years must be spent in screening prospective fields, designing displacement mechanisms, customizing chemicals, conducting pilot projects, lining up equipment, materials, and trained manpower. Thereafter, a delay of one to four years will occur while the recovery agent works its way through the reservoir, displacing the oil toward the producing wells. This short-term delay, however does not mean that higher prices are unproductive with regard to tertiary technology. A higher price immediately will accelerate the overall rate of tertiary recovery applications so that more sophisticated tertiary projects will yield production by 1985, rather than in some later period.

North Alaskan development

In mid-1975, Alaskan crude production averaged 190,000 bbl/d. This production occurred almost entirely within state waters offshore in south Alaska.

Under the BAU outlook and with $13 import prices, Alaskan crude production possibilities reach 3.1 million bbl/d by 1985 -- a sixteen-fold increase in 10 years (Table 2.1.16.5-3). When import prices are expected to be $13,

north Alaskan production is limited to reserves economically viable up to about $10 at the wellhead. This is done to represent, in this chapter, the substantially higher transport costs of north Alaskan oil. Of these, 2.7 million bbl/d depend upon north Alaskan development, principally in and around the Prudhoe Bay area of the North Slope. Major producing areas expected in North Alaska and the route of the Trans-Alaska Pipeline System (TAPS) are shown in Figure 2.1.16.5-11.

These north Alaskan supply possibilities account for about 21 percent of total potential domestic BAU crude production in 1985. Without further effort, however, fully exploiting these possibilities by 1985 would lead by 1989 to a production decline of 0.6 million bbl/d in north Alaska. This factor, coupled with the economics of north Alaskan oil and gas logistics, complicate the Alaskan outlook, and require the careful evaluation of the reserve development potential and the difficult transportation problems.

North Alaska resource and reserve potential

Onshore Alaska oil production possibilities -- as well as those from the Beaufort Sea -- are estimated outside of the FEA model through field-by-field engineering assessments (this methodology, however, produces economically comparable results plus more geographical detail).

Of the 27 billion barrels of undiscovered, recoverable resources estimated by the USGS to exist onshore and offshore in Alaska, the overwhelming share of the potential stems from northern Alaska (Table 2.1.16.5-4). At $13, the BAU outlook envisions that north Alaskan development will convert approximately 50 percent of this resource potential into proved reserves by 1989.

In turn, about 9.6 billion barrels in the Prudhoe Bay field is well-assured with respect to its actual existence and to its economic viability. The confidence associated with the balance of the reserves envisioned under BAU

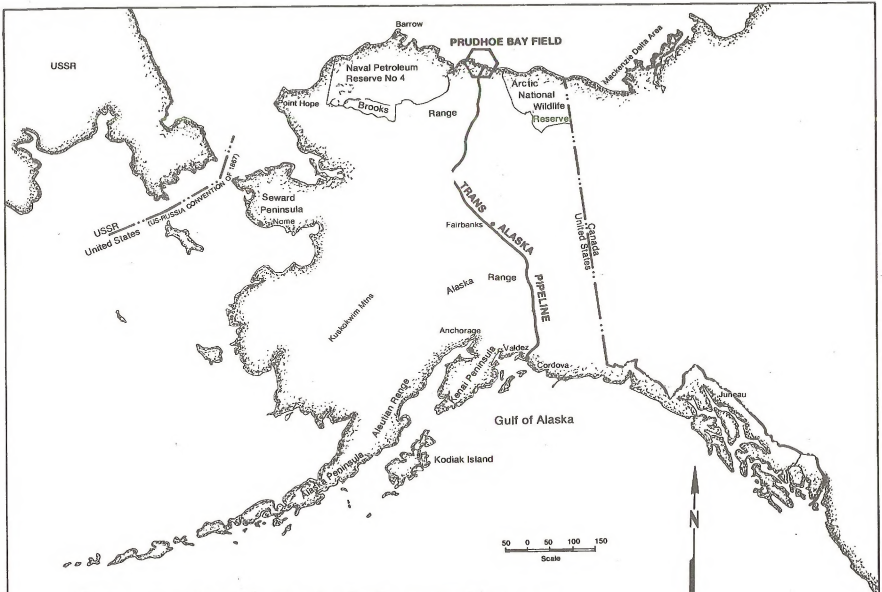


Figure 2.1.16.5-11 North Alaska production areas

contrasts sharply with the Prudhoe Bay field (Table 2.1.16.5-9). The majority of the remainder (other North Slope private) is discovered, but its extent -- and, consequently, the ultimate volume of reserves forthcoming -- is only partially delineated. In turn, its performance under production (especially the producing rate of each well, to which economics in north Alaska are critically sensitive) mainly is assumed by analogy with Prudhoe Bay. Consequently, its economics tend to be speculative.

Table 2.1.16.5-9

Possible North Alaska Reserves at $13

(Billions of Barrels)

AREA	Reserves Expected[a]	Status		
		Discovered	Delineated	Developed
Prudhoe Bay	9.6	Yes	Yes	10%
Other North Slope private[a]	3.2	Yes	Partially	No
Beaufort Sea	2.3	Not leased	No	No
Subtotal BAU:	15.1			
NPR-4[c]	4.0	No	No	No

Source:

[a] Higher prices and technology could increase this amount by about 2.4 billion barrels. Of this, half is estimated to be too expensive at $13; it consists of undiscovered oil around Kavik and a heavy hydrocarbon deposit overlaying the Prudhoe Bay field. The remainder is technically infeasible, awaiting the capacity to drill in waters deeper than 20 feet in the Beaufort Sea.

[b] Consists of four fields: Gwydyr Bay, North Prudhoe, Kuparuk, and Lisburne.

[c] NPR-4 which is included only under the Optimistic outlook, is also illustrated here.

The final portion (the Beaufort Sea) underlies waters not yet leased. Accordingly, not only is its existence geologically uncertain and its economic performance in question, but its accessibility is speculative.

Production possibilities in north Alaska

Production possibilities in north Alaska depend upon the amount of reserves available at various minimum acceptable import prices for crude and its coproducts. The economics of north Alaska logistics, however, generally will control the rate at which production possibilities are translated over time into actual production.

Pipeline capacity to serve north Alaska oil fields must be bought in large increments, each of which represents a large capital expenditure. For example, TAPS (2.0 million bbl/d of pipeline capacity) is expected to cost about $6 billion in 1975 dollars. A two-step looping program -- that is, adding loops to increase the flow in uphill segments to expand TAPS to 3.0 million bbl/d -- would require an additional $3 billion. Additional capacity would necessitate a second pipeline, perhaps, at an additional $6 billion, or more, depending on its route.

Normally, outlays for pipeline capacity are planned to be recovered over an operating life of no less than 10 years; a 15-year life, however, is more typical. Consequently, the reserves to keep full existing planned capacity (2.0 million bbl/d) as well as to sustain the incremental capacity (0.5 million bbl/d) for a minimum of 10 years must be reasonably well in hand in order to promote consideration of looping TAPS.

The key features of north Alaskan development and likely evolution of TAPS' capacity under the BAU outlook are as follows:

1. Expansion of TAPS under the BAU Outlook (and in turn, the actual crude production to be expected from Alaska in the 1980s) depends on the Beaufort Sea (Figure 2.1.16.5-12).

2. Even if the Beaufort Sea proves prolific, and is exploited according to the moderately optimistic schedule envisioned under

BAU, north Alaska production barely can fill a 2.5 million bbl/d TAPS for the minimum 10-year economic life of the first loop.

3. Any looping of TAPS above 2.5 million bbl/d (and, perhaps even occupying fully its 2.5 or 2.0 million bbl/d capacity) depends on greater geological fortune from the already discovered fields as well as on substantial new findings to add production during the post-1985 period. Potential sources of additional north Alaska production possibilities, such as NPR-4, are discussed further under the Optimistic outlook.

4. Maintaining the flow through a looped TAPS after 1985 is particularly dependent upon production from new findings. New findings must occur soon, because construction lead times generally require that the looping decision be made within the next three to four years.

Magnitude of the developmental effort

Since construction of TAPS was initiated in 1973, the pace of development at the Prudhoe Bay field in north Alaska has accelerated dramatically. To complete the development of Prudhoe and to further attain the BAU outlook, the current pace must quicken substantially.

Several things concerning the BAU development effort in north Alaska are important to note. First, the effort requires substantially faster drilling than experienced through 1975. Developmental drilling from 1975 through 1989 (about 1,765 wells) must be more than 20 times larger than has been accomplished to date (75 wells). Three sizable pipeline projects must be substantially completed by 1982: a Beaufort Sea link to TAPS, a gas pipeline, and the first TAPS loop (Figure 2.1.16.5-13). The developmental capacity -- ignoring the effects of new discoveries -- is both front-end

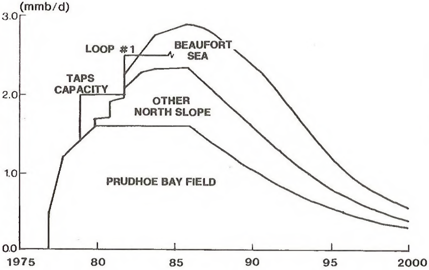


Figure 2.1.16.5-12 North Alaska crude production (BAU) 1975-2000

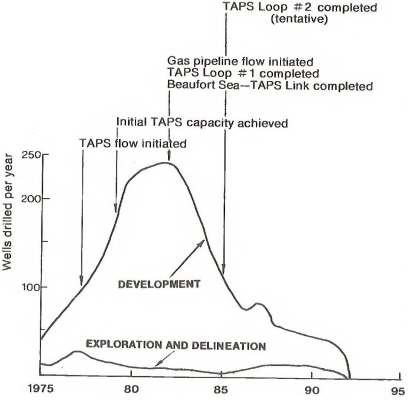


Figure 2.1.16.5-13 North Alaska drilling and logistical effort (BAU)

loaded and highly peaked. That is, development drilling will increase rapidly until 1983 and will quickly decline thereafter (Figure 2.1.16.5-13).

The major observation with respect to north Alaskan development is that the BAU oil supply outlook is far from the status quo. The results expected from the outlook require an expeditious mobilization of effort, encompassing institutional steps such as leasing and substantial money and "bricks and mortar."

Development of Alaska beyond the BAU outlook will require more than large capital investments, geological success, and extensive drilling and logistics; it could also involve large-scale construction and influx of population in many sensitive areas. Any Alaskan development will need careful consideration of attendant environmental and socioeconomic impacts. Such consideration implies a high degree of cooperative effort among Federal, state and local officials, and private parties.

Supply uncertainties: The Optimistic and Pessimistic supply outlooks

The description of the BAU supply outlook discussed the influence of geology on the price response of Lower-48 onshore supply. It also noted the nonprice constraints which bind tertiary recovery supply possibilities (e.g., speculative technology) as well as the Lower-48 OCS (e.g., leasing rate) and Alaska (e.g., logistics). The combined effect of these major estimating assumptions is large.

Consequently, a large degree of uncertainty surrounds the central BAU supply possibilities forecast. This uncertainty consists of three elements: geological potential, technology (in the case of tertiary recovery), and the policy environment (evidenced in the leasing rate and achievable rates of development in Alaska). Of the many questions which pervade any attempt to estimate future oil supply, these are three of the most important and fundamental ones.

To delineate the uncertainty about the future oil supply, the BAU outlook is bracketed by two others. One, Pessimistic, reflects a geological outlook which has approximately four chances out of five of actually being at least this amount. The Pessimistic outlook couples this more certain (but lower) resource potential with less successful and less aggressively applied tertiary recovery technology. Finally, this outlook envisions a lower rate of leasing and a slower buildup of Alaskan facilities.

The other outlook, Optimistic, reflects lower geological confidence, one which has about one chance in five of actually containing this amount of resources. Geological optimism is coupled with comparable optimism regarding tertiary recovery, the leasing rate, and the attainable pace of Alaskan development. The estimating assumptions underlying both of these additional outlooks are summarized in Table 2.1.16.5-10.

Uncertainty effects on total crude production

There is considerable variation in crude production possibilities as assumptions are modified. In 1980 and at $13 the Optimistic outlook is 3.9 million bbl/d higher than the Pessimistic outlook (Figure 2.1.16.5-14). This difference of 3.9 million bbl/d represents almost twice the production expected from the Alaskan North Slope in 1980.

The implications of uncertainty are large by 1980, and continue to increase over time. By 1985 at $13, the Optimistic forecast is almost 70 percent higher than the Pessimistic, and the difference continues to increase.

These two factors -- uncertainty and its increasing influence as estimates reach further into the future -- produce widely varying outlooks for the direction of domestic oil supply and prices in the longer term. At $8, all but the Optimistic outlook show a steady decline from today's production levels throughout the forecast period. At $13, all outlooks evidence some potential supply increase through 1980. After 1980, however, Pessimistic

Table 2.1.16.5-10

Optimistic and Pessimistic Outlook Assumptions

RESOURCE ASSESSMENT[a]	Pessimistic USGS "Mean" Minus One Standard Deviation	BAU USGS "Mean"	Optimistic USGS "Mean" Plus One Standard Deviation
OCS leasing (1975-1984)	18.2 million acres	26.8 million acres	38.2 million acres
Investment tax credit	10% through 1977; 7% thereafter	10% through 1977; 7% thereafter	10% throughout
Alaskan pipeline capacity	2.0 MM bbl/d in 1980 2.0 MM bbl/d in 1985	2.0 MM bbl/d in 1980 2.5 MM bbl/d in 1985	2.0 MM bbl/d in 1980 4.5 MM bbl/d in 1985
Price controls	Removed within a few years	Removed within a few years	Removed within a few years

Source: FEA, 1976.

[a] The USGS mean value for undiscovered, recoverable resources was shown in Table 2.1.16.5-4 with a 95-5% confidence level. To reflect pessimism, the mean value minus one standard deviation was utilized, and to reflect optimism the mean plus one standard deviation was used. This amounts to generally an 80-85% confidence level for the Pessimistic Outlook, and a 15-20% confidence level for the Optimistic Outlook.

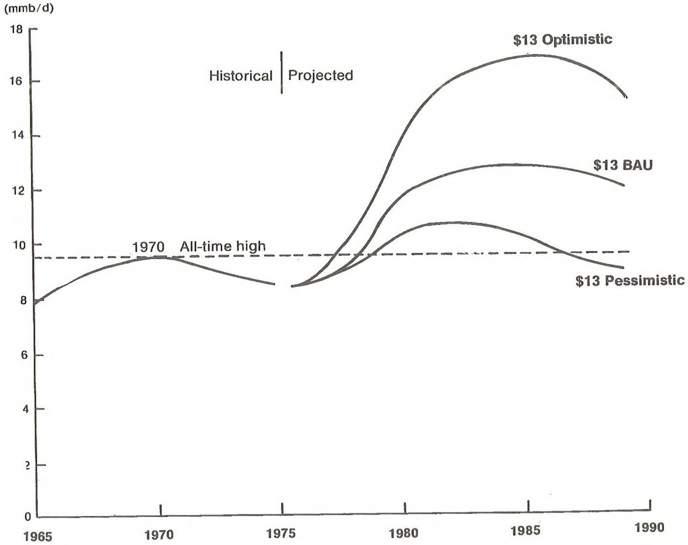


Figure 2.1.16.5-14 Crude oil production under alternate outlooks 1965-90

declines rapidly and BAU remains steady. The Optimistic outlook increases until 1985, then a slow decline commences (Figure 2.1.16.5-14). At $16, the Pessimistic outlook still reflects a supply potential somewhat akin to today's levels through 1989. The other two outlooks increase over the entire forecast period.

Components of oil supply uncertainty

The changes in the oil supply possibilities across the three supply outlooks have geographical, resource base, and recovery method implications (Table 2.1.16.5-11).

Table 2.1.16.5-11

Alternative 1985 Production at $13 Price

RESOURCE/LOCATION	Supply Outlook (Million Barrels per Day) Pessimistic	BAU	Optimistic
Lower-48 onshore			
New field primary/secondary	1.3	1.9	2.1
Old field secondary	2.0	2.0	2.7
Tertiary	0.8	1.0	1.5
Initial reserves	2.4	2.4	2.4
Subtotal	6.5	7.3	8.7
Lower-48 OCS			
Pacific	0.5	0.6	0.9
Gulf of Mexico	1.1	1.4	1.9
Atlantic	0.1	0.1	0.2
Subtotal	1.7	2.1	3.0
Alaska			
Beaufort Sea		0.4	0.7
Other OCS	0.3	0.4	0.5
North Slope	1.4	2.3	2.7
NPR-4			0.9
Subtotal	1.7	3.1	4.8
Other			
NPR-1		0.2	0.2
Tar sands			
Heavy hydrocarbons	0.2	0.2	0.3
Subtotal	0.2	0.4	0.5
Total crude	10.1	12.9	17.0
Natural gas liquids	1.7	1.8	2.1
Total liquids	11.8	14.7	19.1

Source: FEA, 1976.

The following observations are important:

1. Uncertainty occurs evenly across all of the major components of potential supply, on both the Pessimistic side and the Optimistic side of BAU.

2. On the Pessimistic side, however, less fortunate geological experience on the Lower-48 onshore (0.8 million bbl/d), the rate of OCS leasing (0.4 million bbl/d), and the production rate which can be sustained on the North Slope (0.9 million bbl/d) stand out as the major uncertainties. These three elements account for 75 percent of the lower supply possibilities represented in the Pessimistic outlook.

3. Alternatively, on the Optimistic side, better tertiary recovery results combine with more fortunate geological experience to cause a 1.4 million bbl/d higher estimated supply potential. Offshore leasing (0.9 million bbl/d) and the combination of access to and successful results in NPR-4 (0.9 million bbl/d) add another 3.2 million bbl/d to the Optimistic Outlook compared to BAU. These three elements again account for about 75 percent of the elevated potential estimated under the Optimistic outlook.

An important twofold message lies behind these widely varying production outlooks. First, geological uncertainty of the magnitude reflected in USGS Circular 725, coupled with the economic unknowns in untried frontier areas, produce major uncertainty in future production estimates. It may be that even very large sums expended on refining geological assessments and hypothetical petroleum engineering estimates could not reduce substantially the intrinsic uncertainty underlying domestic oil resource potentials.

Second, a large degree of this uncertainty is not intrinsic in nature but rather is policy-determined. Geological uncertainty may not respond

dramatically to a much larger effort; however, the reliability of tertiary technology and the availability of supply from the OCS and Alaska (through leasing and more intensive development) probably will. Thus, the importance of resolving outstanding policy questions on these subjects is very clear.

Major areas of uncertainty in the oil supply outlook

The four major areas of uncertainty in the oil supply outlook are the resource base, drilling effort, OCS leasing schedules, and enhanced recovery. The Optimistic and Pessimistic supply possibilities incorporate different assumptions concerning these factors. The incremental impact on 1985 crude oil production at $13 varies with these assumptions (Table 2.1.16.5-12).

Table 2.1.16.5-12

Contribution to Estimating Uncertainty From Geologic, Drilling, Leasing, and Alaska Scenarios

CONTRIBUTION	1985 Crude Oil Production (MMbbl/d) Optimistic Scenario	Pessimistic Scenario
BAU base production	12.9	1212.9
Geological[a]	+1.1	-0.7
Drilling	+0.3	-0.1
Leasing	+0.9	-0.4
Alaska and other	+1.8	-1.6
Scenario Production	17.0	10.1

Source: FEA, 1976.

[a] Enhanced recovery is implicit in these figures.

Inferred reserves and undiscovered recoverable resources

Table 2.1.16.5-13 presents alternative geological outlooks.

Table 2.1.16.5-13

USGS-725: Alternative Geological Outlooks

RESOURCE	Billions of Barrels		
	Pessimistic	BAU	Optimistic
Measured reserves	34.3	34.3	34.3
Inferred reserves	18.5[a]	18.5[a]	23.1
Subtotal: Reserves	52.8	52.8	57.4
Undiscovered recoverable			
Lower-48 onshore	28.0	44.0	60.0
OCS[b]	15.6	33.0	49.6
Alaska onshore	7.7	12.0	16.3
Subtotal	51.3	89.0	125.9
Total	104.1	141.8	183.3

Source: FEA, 1976.

[a] Adjusted to reflect lower east Texas inferred.

[b] Adjusted to include water depths greater than 200 meters.

Points to be noted concerning resource levels chosen for each scenario are:

1. The Optimistic resource levels are determined statistically and correspond to about a one-in-five chance that they are this high.

2. The Pessimistic resource levels have approximately a four-in-five chance to be at least this much.

3. The higher inferred reserve level in the Optimistic supply outlook is a result of subjective judgment by the USGS concerning

inferred reserves in east Texas, this departs from normal USGS statistical procedure by reporting a more optimistic quantity. The more conservative statistical estimate was used for the BAU and Pessimistic outlooks.

Drilling levels

Increased drilling is largely the result of the higher resource base, but also the result of other factors which are varied for each outlook (Table 2.1.16.5-14). OCS drilling increases because of increased leasing which will be discussed as the next area of uncertainty. The largest part of the drilling difference onshore occurs late in the forecast as drilling "builds up" or "runs down," which consequently lessens the impact on 1985 production (Figure 2.1.16.5-15).

Table 2.1.16.5-14

Impact of Alternative Supply Outlooks on Drilling Activity at $13

LOCATION	Millions of Feet Drilled: 1975-1985		
	Pessimistic	BAU	Optimistic
Lower-48 onshore	833.4	1,144.3	1,405.8
OCS	151.8	212.1	297.0
Total	985.2	1,356.4	1,702.8

Source: FEA, 1976.

OCS leasing

The difference in OCS leasing schedules occurs solely because of a variance in the assumed acreage per lease sale. The BAU outlook assumed 800,000 acres per sale would be offered; whereas the Optimistic outlook assumed 1,200,000 acres and the Pessimistic, 500,000 acres (Table 2.1.16.5-15).

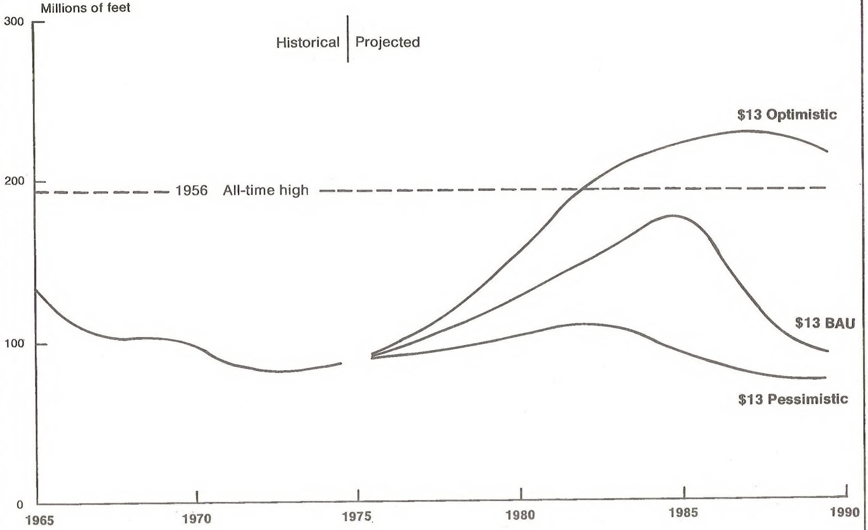


Figure 2.1.16.5-15 Drilling activities for oil under alternative outlooks 1965-90

Table 2.1.16.5-15

OCS Leasing Schedules Under Alternative Scenarios

PERIOD	Millions of Acres Leased		
	Pessimistic	BAU	Optimistic
1975-79	11.3	15.8	21.7
1980-84	6.9	11.0	16.5
1985-89	4.7	7.6	11.8
Total	22.9	34.4	50.0

Source: FEA, 1976.

Enhanced recovery

There are considerable differences of opinion among experts as to which enhanced recovery techniques are applicable to which reservoirs, or whether they are applicable at all. These differences account for the variations in projected reserves and production rates for specific times in the future.

To reflect this uncertainty, the Pessimistic and Optimistic supply outlooks have different levels of enhanced recovery (Table 2.1.16.5-16).

Table 2.1.16.5-16

1985 Production From Enhanced Recovery Under

Alternative Outlooks at $13

TYPE RECOVERY	Outlook		
	Pessimistic	BAU	Optimistic
Secondary (MMbbl/d)			
Old fields	2.2	2.2	3.3
New fields	0.3	0.4	0.4
Subtotal	2.5	2.6	3.7
Tertiary (MMbbl/d)			
Old fields	0.6	0.9	1.2
New fields	negligible	negligible	0.1
Subtotal	0.6	1.0	1.3
Total enhanced production (MMbbl/d)	3.1	3.6	5.0

Source: FEA, 1976.

In regard to enhanced recovery, secondary recovery from old fields remains at the same level for both Pessimistic and BAU outlooks, as it is targeted to USGS indicated and inferred reserves. Tertiary recovery shows a large range of possibilities, from 0.6 million bbl/d to 1.3 million bbl/d in 1985 at an expected import price of $13 per barrel. These production quantities were based on high and low estimates, given that tertiary recovery processes prove out in practice. Enhanced recovery in the Optimistic outlook increases from a 1975 high of around 2.0 million bbl/d to 5.0 million bbl/d. However, enhanced production still accounts for only 30 percent of total production, a figure only slightly up from the present 25 percent. The timing of production from enhanced recovery technology is affected by many variables which are not yet fully understood. One of these key variables is economics, important since there is a 3 to 5 year time lag between investment and oil recovery. Economic factors, however, still remain speculative since so few field-wide commercial applications have been undertaken

that there is an insufficient data base for generalization. Also, some techniques require chemicals or compounds which are not currently available on a large scale.

Uncertainties in northern Alaskan development

Alaskan crude production in 1985 at $13 was shown to vary from 1.7 million bbl/d (Pessimistic) to 4.8 million bbl/d (Optimistic), as indicated in Table 2.1.16.5-11. This difference represents 45 percent of the total swing between outlooks in potential domestic crude supply in 1985. Northern Alaska makes up 2.9 million bbl/d of this difference. Three things account for the large uncertainty there: geological fortune, rate of development, and accessibility to NPR-4 (itself additionally contingent upon geological success and rate of development).

Each of the alternative outlooks varies from BAU to a large extent because of the rate of development. Both, however, do represent varying degrees of geological fortune. In the Pessimistic case, worse geological experience occurs in the fields envisioned to prove productive and economically viable under BAU (Table 2.1.16.5-17).

For the Optimistic case, the BAU fields are worked more quickly; no greater amounts of reserves are expected. In contrast, NPR-4 reflects the joint effects of geological fortune and an expeditious development program. It can be argued that the fate of NPR-4 hinges on future geological fortune, because 30 years of geological work in NPR-4 has yet to establish a single "reserve" in the sense applied anywhere else across the domestic petroleum resource picture.

Under BAU conditions, the coordination required between production capacity and logistical capacity was described. The coordination problem, of course, becomes even more delicate in the face of widely

varying uncertainty about the magnitude of resources available in northern Alaska, the timing of accessibility to them, and rates of productive capacity buildup that might be achieved. Figure 2.1.16.5-16 portrays trajectories of the three alternative production possibilities for northern Alaska as well as the implications of the Optimistic outlook for TAPS capacity requirements.

Table 2.1.16.5-17

1985 Components of Northern Alaska Uncertainty

COMPONENT	Alternative Outlook (MMbbl/d)	
	Pessimistic	Optimistic
Business-as-usual	2.7	2.7
Geological fortune	-0.5	
Rate of development	-0.8	+0.7
NPR-4		+0.9
Alternative outlook	1.4	4.3

Source: FEA, 1976.

The most important points which emerge from the figure concern the maximum production likely to be realized under the Optimistic outlook. Although peak production possibilities of about 4.5 million bbl/d are estimated, expansion of TAPS beyond loop No. 2 (3.0 million bbl/d) looks doubtful for two major reasons:

1. Coincident production peaks, caused by rapid buildup of northern Alaskan production from all likely fields through 1985, lead to an equally sharp decline thereafter.

2. Since achieving the 4.5 million bbl/d peak requires bringing 60 percent of the USGS-estimated resource base into play, finding reserves to fill another pipeline more than temporarily, while maintaining 3.0 million bbl/d throughout for a doubly looped TAPS,

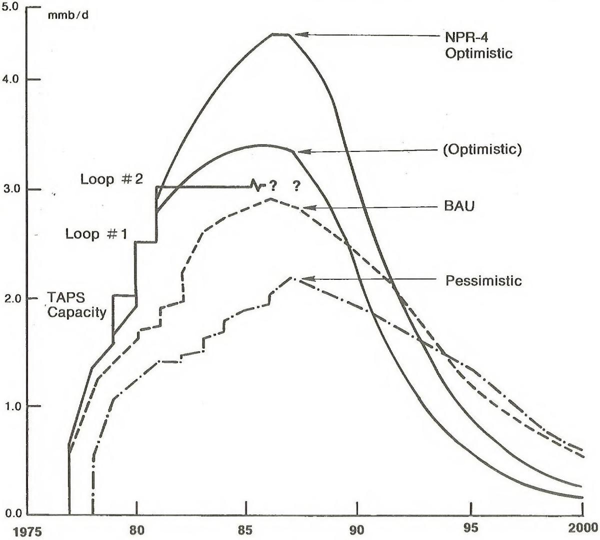


Figure 2.1.16.5-16 Outlooks for North Alaska crude production 1975-2000

will be difficult. Perhaps additional recovery and inclusion of additional deposits in the recoverable resource base, at higher prices than imagined in USGS Circular 725, would alter this assessment.

From this perspective, the likelihood of loop No. 2 appears to depend heavily on either NPR-4 or the portion of the resource base not covered in this outlook. The same point made earlier under BAU concerning TAPS loop No. 1 obtains equally here: The expansion of TAPS capacity to 3.0 million bbl/d by 1985 requires that the reserves to support it be identified soon.

Toward the Pessimistic end of the spectrum of northern Alaskan production possibilities, incremental TAPS capacity is a lesser issue. There, it appears that the disposition of NPR-4 (with institutional difficulty results partly from the requirement for a major, 400-mile pipeline required to link up with TAPS) may control the future of loop No. 1.

The major point concerns the uncertainty, not the wisdom of any one specific TAPS capacity. At this juncture, the question of appropriate TAPS capacity for 1985 is impossible to calculate. The key to the solution is more tangible knowledge about the resource base, both how much is there, and at what price it becomes economically viable. In turn, obtaining tangible knowledge requires geological/geophysical work and exploratory drilling.

<u>Estimating approach and FEA model</u>

The BAU estimating assumptions are converted to oil supply estimates through two separate estimating tools. Oil supply estimates for the Lower-48 and most of the Alaskan OCS are derived using an FEA model, which deals in aggregate fashion with 12 large geographical areas.

The most speculative, immature areas (the Alaskan North Slope, Beaufort Sea, and the National Petroleum Reserves) are estimated through individual

engineering-oriented assessments. These engineering-oriented assessments provide geographical detail, but otherwise calculate supply possibilities consistent with the FEA model.

The original FEA oil supply model, utilized in the 1974 "Project Independence Report," used subjective judgments about resources, drilling levels, recovery rates, decline rates, costs, and other factors to produce annual production quantities for each of 12 petroleum regions. Since these estimates, the model has been improved in four major ways:

1. Total oil drilling is estimated within the model, and its allocation among regions is derived rather than judged subjectively.

2. Finding rates and enhanced recovery rates are linked formally to USGS estimates of the domestic resource base.

3. OCS leasing schedules are translated into drilling schedules and production levels using regional parameters which better represent the unique geological characteristics of each OCS area.

4. All other estimating factors have been reviewed and substantially revised, based on an additional year of actual supply experience.

The major inputs to the model are:

Resource assessments. These data consist of existing oil in place, reserve levels, and estimates of future reserves potentially available from both known fields and newly discovered fields.

Recovery factors. These regional factors are based on historical analysis, and estimate the percentage of oil in place found which will consequently be

produced. There are, in fact, six recovery factors for each region, one for each "type" of production.

<u>Depletion factors</u>. These regional factors are based on 1974 production history, and pertain to the rate that crude oil is produced from reserves. These factors provide for a systematic dwindling of existing reserves which have to be replaced by new discoveries in order to maintain production levels.

<u>Costs</u>. Costs are of two types: drilling costs and other investments necessary to find oil and convert it to proved reserves, and operating costs necessary to produce the oil from reserves, once proved. These cost factors have been estimated from historical analyses and from judgmental decisions concerning cost escalation due to deep wells, for example.

The above major inputs (and many other less critical factors) permit the model to derive annual regional production figures at different price levels. Briefly, the calculation procedure consists of six broad steps:

1. The expected oil price and drilling rig supply parameters combine to determine the total domestic oil drilling over time and its allocation among 12 oil regions.

2. Finding rates, derived from USGS resource assessments, then combine with drilling to determine the amount of oil-in-place found by the drilling process.

3. Regional recovery rates -- one for each of three recovery methods in old and in new fields -- combine with various lead time factors to allocate successive portions of this oil-in-place into proved reserves.

4. As each portion of the oil-in-place is proved, the minimum-acceptable price at which it becomes economically attractive is calculated. The calculation consists of a discounted cash flow analysis of each reserve addition. This calculation considers the investment required to prove it, the operating costs subsequently required to produce and sell it (e.g., royalties), and the time profile over which it will be produced and sold.

5. Depletion factors -- or decline rates -- are used to calculate future annual production resulting from proved reserves added each year at each minimum-acceptable price.

6. Finally, in each year the production which is available at successively higher prices is cumulated to produce a curve of production versus price (or a supply curve).

Long-term demand and forecast

The Project Independence Evaluation System (PIES) links the supply projections delineated in this chapter with demand scenarios for each sector of the economy. The linkage is accomplished in the main PIES linear programming model which finds an equilibrium solution for domestic consumption and total supply of all energy resources. It determines this equilibrium solution by considering the flow of energy resources from areas of supply to areas of consumption, and supplements any shortfall in domestic production with imports. The PIES model does this for a range of energy scenarios and for several prices.

Under the PIES Reference Scenario, there is a wide variation between demand growth rates at three imported oil prices; $8, $13, and $16 (Figure 2.1.16.5-17). This growth is based on BAU supply possibilities at these same prices. At $8 world oil prices, domestic consumption rises at a compounded growth rate of 3.9 percent between 1974 and 1985. Imports of

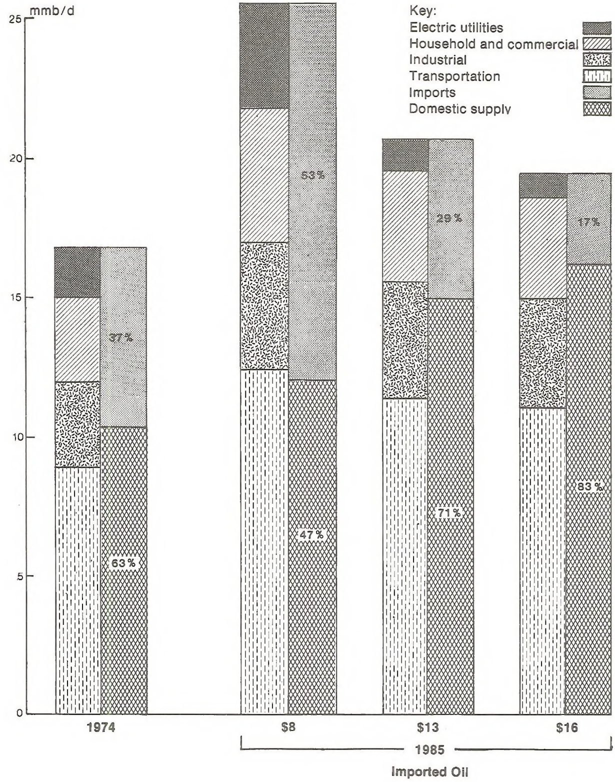


Figure 2.1.16.5-17 Outlook for petroleum consumption by sector and source (projected)

nearly 14.0 million bbl/d must be brought in to fill the gap between consumption and domestic production. At $13 domestic consumption increases at about half the historical pace, or about 2.0 percent compounded annually. Domestic production fills 70 percent of this demand in 1985, and imports of only 6.0 million bbl/d are necessary to fill the gap. At $16 world oil prices, consumption grows at a slower rate of only 1.4 percent per year, and domestic production supplies all but about 3.0 million bbl/d of that amount by 1985.

These same consumption solutions can also be broken down by consuming sector (Figure 2.1.16.5-17). Table 2.1.16.5-18 illustrates sector demand at $13 world oil prices. The transportation sector is quantitatively the largest of the final consuming sectors, accounting for about half of total oil demand. The trend towards smaller, more fuel-efficient automobiles is expected to continue and to have a major impact in reducing demand growth between now and 1985. At $13 world oil prices, consumption of oil by electric utilities is expected to decline substantially as coal and nuclear plants replace oil in base-loaded generation. At higher or lower prices, electric utilities show the greatest level of demand elasticity of all the sectors, and at $8, consumption by this sector rises from 6.5 to 16.0 percent of total comsumption. In the household/commercial sector, the effect of a substantial rise in delivered oil prices is partially offset by an equivalent rise in decontrolled natural gas prices, thus maintaining the share of oil for heating in the 1974-85 period. About 30 percent of petroleum consumption in the industrial sector is for raw materials and coking, and is not very sensitive to price. This reduces the impact of rising prices on consumption.

Table 2.1.16.5-18

Historical and Forecast Annual Oil Demand Growth Rates, by Economic Sector

ECONOMIC SECTOR	1960-72	1972-74	Reference Scenario[a] 1974-85
Transportation	4.3%	1.3%	2.1%
Electric utilities	15.4	5.4	-2.3
Household/commercial	2.6	-4.7	2.8
Industrial	3.7	2.1	3.1
Total	4.2%	0.7%	2.0%

Source: FEA, 1976.

[a] At $13 per barrel imported oil.

Summary and implications of alternative outlooks

Several things are important to note concerning BAU oil supply possibilities (Figure 2.1.16.5-8). The effects of price are large and cumulative; 1976 price expectations set a course of activity whose results are not felt immediately, but, once felt, continue indefinitely. Under $13 expectations domestic oil supply can regain its pre-1970 upward trend. Under the assumed BAU conditions (leasing constraints, moderate tertiary technology success, and a large, but not crash, Alaskan development effort), supply possibilities at $13 will have peaked in 1985 and will trend downward once again. At a low price of $8, BAU crude oil production maintains current levels. At a higher price of $16, crude oil production until 1985 proceeds on a slightly higher trajectory than at $13, averaging about 0.5 MMbbl/d higher. By 1985, however, when the $13 supply trajectory peaks and begins to decline, supply possibilities at $16 continue to trend upward to peak at a point beyond 1990.

The effort necessary to produce these BAU oil supply possibilities is large by historical standards (Figures 2.1.16.5-10, 2.1.16.5-18, and 2.1.16.5-19). A massive exploratory and developmental drilling effort is required. Annual oil drilling must more than double by 1985, to approach its all-time high reached in 1956. In addition to drilling, accomplishment of these supply possibilities requires a high level of Federal OCS leasing. The most comprehensive measure of the total effort is the capital required to fuel it. Capital expenditures for oil must more than double (in constant 1975 dollars) by 1985. Tertiary recovery must succeed technically and economically, and must be applied at a moderately brisk pace. Also, northern Alaskan development must proceed at a rate capable of expanding Alaskan crude production sixteen-fold over 10 years.

With respect to the estimated oil supply possibility outlooks, final results will depend on geological fortune, technology (in the case of tertiary recovery), and the policy environment. It is in these areas that the large uncertainty in future potentials appears impossible to resolve at this point. Unfortunately, the implications of this range of outcomes for oil supply possibilities is very large (Figure 2.1.16.5-14).

First, a large share (about half) of this variation across outlooks accurately portrays the fundamental geological unknowns inherent in the oil business. These are revealed directly in USGS Circular 725. These geological unknowns -- and the economic uncertainty they create in a forecast dominated by frontier areas -- can only be expected to produce an uncertain forecast of oil production possibilities 15 years forward in time. Large geological/geophysical expenditures and hypothetical petroleum engineering estimates of economic potential may not substantially reduce the uncertainty intrinsic to domestic oil resources.

A large degree of uncertainty, however, is not natural, but rather, is policy-determined. Geological uncertainty may not respond dramatically to

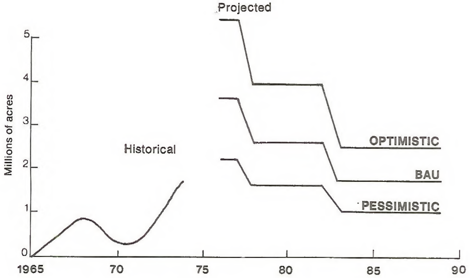


Figure 2.1.16.5-18 Outer continental shelf leasing schedules 1965-90

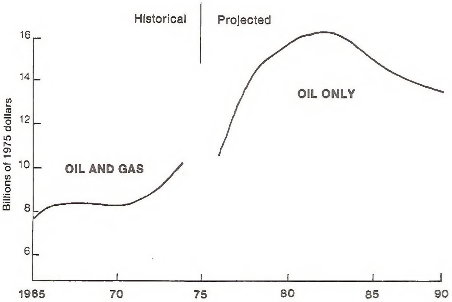


Figure 2.1.16.5-19 Capital expenditures by the petroleum industry 1965-90

our will. In contrast, policy-determined uncertainty should respond to effort.

Energy perspectives

The shock felt throughout America and the rest of the oil importing countries at the onset of the Arab embargo has subsided. Consumer nations have reacted sharply to the higher world oil prices. The International Energy Agency (IEA) was established under the aegis of the Organization for Economic Cooperation and Development. Supply security has been a primary concern, but considerable attention has also been given to the issue of higher oil prices and longer-term energy matters. The IEA has developed an emergency program which calls for a coordinated response in the event of a future oil embargo. IEA members also have developed plans for long-term cooperation on conservation, research, resource development, and access to supply.

As higher prices and conservation reduced world oil demand, the Organization of Petroleum Exporting Countries (OPEC) has been forced to reduce production to prevent prices from falling. Excess OPEC productive capacity has increased greatly since the embargo and now amounts to an estimated 10 to 12 million bbl/d or one-third of total OPEC capacity. OPEC production, which had increased steadily for nine years, declined from 31.2 million bbl/d in 1973, to about 27 million bbl/d in 1975. The major cutbacks were absorbed by Saudi Arabia, Libya, and Kuwait. Nevertheless in 1975, OPEC's members approved a 10 percent increase in the price of Saudi Arabian marker crude oil, from $10.51 per barrel to $11.56.

Natural gas

Natural gas supplied about 30 percent of the U.S. energy in 1975 and about 40 percent of the nontransportation uses. Approximately 21 trillion cubic feet were consumed in 1974. Although pipeline imports from Canada are an important source of natural gas in some regions (e.g., the Pacific Northwest), they account for less than 5 percent of annual consumption.

Because of the clean-burning properties of natural gas, its low regulated price compared to alternate fuels and, until the late 1960s, abundant supply, demand has been increasing. Marketed natural gas production, however, peaked in 1973 at 22.6 trillion cubic feet, and dropped significantly for the first time in 1974. This pattern continued in 1975 with production down another 7 percent, to 20.1 trillion cubic feet.

Since 1968, the Lower-48 states have been consuming more natural gas each year than producers have been finding in the form of new reserves. Natural gas reserves for 1974 in these states were about 208 trillion cubic feet, the lowest level since 1952. Except for 26 trillion cubic feet discovered in Alaska in 1970, annual additions to reserves have failed to equal marketed production for the past seven years. Moreover, Alaskan reserves will not provide significant amounts of gas until the 1980s because of the absence of necessary transportation facilities.

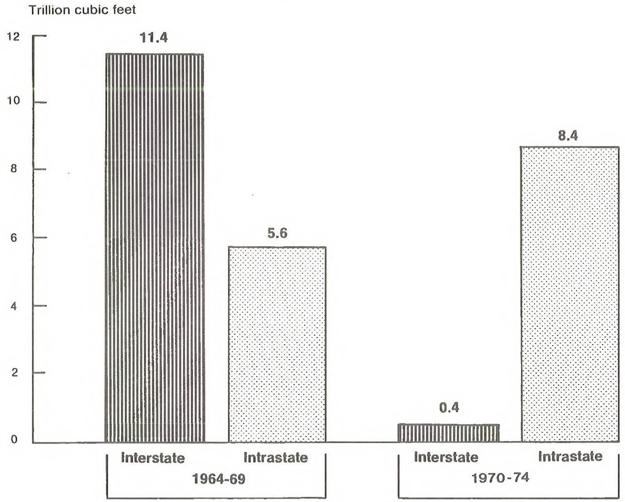
Low regulated prices have encouraged consumption and discouraged the search for new gas to supply the interstate market. Within the past five years, intrastate prices have been rising faster than the regulated prices for gas sold to interstate pipeline companies. As a consequence, the disparity in new contract prices between intrastate and interstate markets has widened considerably. Producers have been selling gas under new contracts at an average price of $1.00 to $1.50 per thousand cubic feet (Mcf) in the intrastate market compared to the regulated interstate ceiling price of 52 cents per Mcf. Since 1970, this price differential has led to the

development and sale of most new natural gas within the state where it is produced. Over 90 percent of all reserve additions since 1970 have been dedicated to intrastate markets in contrast to a 60 percent figure for the five previous years (Figure 2.1.16.5-20).

Six states, Texas, Louisiana, Oklahoma, California, New Mexico, and Kansas, accounted for 93 percent of domestic production in 1974; Texas and Louisiana alone provided 73 percent. In 1974, approximately 50 percent of domestic comsumption of natural gas was in these six states, largely because of industrial relocation in the 1960s and use of natural gas by chemical manufacturers and electric utilities in these states.

Curtailments of supply to the price regulated interstate pipelines are expected to increase as total supplies continue to decline and available gas is dedicated to the unregulated intrastate market. In 1970, curtailments reported by interstate pipelines were less than 1 percent of requirements. By 1974, curtailments increased to 10 percent of total requirements and were forecast to rise to as much as 15 percent in 1975. The economic impacts of this shortage, however, were greatly mitigated by the switching of industrial users from natural gas to higher priced alternative fuels (propane, residual or distillate oil); mild weather conditions; conservation; limited emergency gas deliveries; and a Federal Power Commission ruling that enabled high priority, curtailed industrial users of natural gas to purchase uncommitted gas directly from producing states at unregulated prices.

The major economic effects of the curtailments in the East and Midwest resulted from the higher costs of alternative fuels. These costs reduced the ability of industrial firms to compete with similar firms in other areas that did not have to utilize high-priced alternate fuels. In addition, curtailments have led to widespread adoption of restrictions on new natural gas connections of residential and commercial space heating.



Source: American Gas Association, Federal Power Commission

Figure 2.1.16.5-20 Average annual reserve additions of natural gas

The current natural gas supply-and-demand picture in southern California is one of a growing imbalance. Declining supplies are failing to meet requirements despite conservation efforts in both homes and industry. As a consequence, consideration of the SOHIO proposed natural gas pipeline conversion appears related directly to "supply" and is virtually independent of "demand" or "requirements" in gas industry terminology. From the most optimistic projections for natural gas supply, there still appears little hope that demand requirements will be met through 1985. Hearing Exhibits submitted by W. B. Wood and John H. Belson of Southern California Gas Co. to the Federal Power Commission display a relatively optimistic supply scenario with added supply available to California from Indonesia LNG (Docket No. CP74-160), Coal Gasification (Docket No. CP73-211), Pacific Alaska LNG (Docket No. CP75-140), Pacific Interstate (Docket No. CP76-104), and a North Slope Increment (Docket No. CP74-292).

Even under this scenario, the peak supply year from 1976 to 1985 is 1981 with a "total supply for resale and own use" of 958 billion cubic feet per year (cf/yr). Demand requirements are estimated as 1,720 billion cf/yr for 1981 in an "average" weather year. With "supply" thus estimated at only 56 percent of "demand" in an "average" weather year, "demand" reduction targets of "8 to 10 percent" are academic. Table 2.1.16.5-19 assumes even more optimistic supplies by adding the effects of deregulation (FPC Case IV), the El Paso Burnham Coal Gasification project, and the assumption that all sources supply gas to southern California only.

The brunt of the shortage in supply has been absorbed by the steam-electric plants in southern California. Despite warmer than average winter conditions, these steam-electric plants were able to obtain only 11 percent of their annual natural gas requirements in 1975. Projections through 1985 hold out little hope of any natural gas availability for steam-electric plant usage in southern California even with the optimistic addition of new gas value from Alaska, Indonesia (LNG) and Utah (SNG).

Table 2.1.16.5-19

Supply/Demand Ratio

Southern California Natural Gas Usage

1970-1985

YEAR	All Source "High Volume" Supply Case (Billion cf/yr) [a]	Southern California Demand (Billion cf/yr) [b]	Percent Supplied
1970	1,192	1,328	90
1971	1,175	1,418	83
1972	1,129	1,402	80
1973	1,047	1,510	69
1974	978	1,346	73
1975	909	1,473	62
1976	837	1,559	54
1977	821	1,601	51
1978	775	1,683	46
1979	809	1,747	46
1980	982	1,801	54
1981	1,278	1,823	70
1982	1,270	1,812	70
1983	1,398	1,787	78
1984	1,379	1,807	76
1985	1,364	1,818	75

[a] Supply, actual through 1974. Estimates from 1975 to 1985 based on FPC Case IV from Natural Gas Survey for pipeline supplies plus South Alaska LNG, North Slope Alaska Increment, WESCO and Burnham Coal Gasification, and Indonesia LNG.

[b] Demand, actual through 1974. Estimates from 1975 to 1985 are based on 1975 California Gas Reports which do not include an energy conservation effect (possibly 8-10% higher than Southern California Gas Co. Indonesia Exhibits).

Electric power

The increased fuel prices of the past two years have had a significant impact on the electric utility industry. The higher fuel costs, combined with already escalating plant construction and operating costs, have escalated electricity rates. The increases have caused consumer unrest and demands for changes in rate structures. With today's oil prices and the natural gas shortages, the economics of new plants has shifted to coal and nuclear power. Higher prices also have reduced demand and this, in turn, is likely to reduce future capacity needs. These effects, coupled with continuing debate over environmental, siting and safety issues, and financial problems in the utility industry, have introduced significant uncertainties into the outlook for electricity growth.

For many years, electric power demand grew at an annual rate of about 7 percent. Additions to generating capacity planned for the years through the early 1980s were based on this preembargo rate of demand growth. In 1974, however, the growth rate for electricity fell to zero and only increased by about 2 percent in 1975. This phenomenon is largely attributable to reduced consumption in response to higher prices and the economic slowdown.

Prices have risen most significantly in regions which rely heavily on residual oil for electric power. New England and the mid-Atlantic states, for instance, recorded price increases averaging more than 35 percent in 1974, and consumption declined significantly.

The financial situation of electric utilities has been dramatically affected by higher fuel costs, which necessitated large rate increases. The increases then deepened resistance to further rate adjustments. At the same time, lower-capacity utilization, lengthening times of licensing and construction, and high inflation associated with new plant constuction required even greater rate increases if utilities were to finance new plants. When these were not forthcoming, the firms' ability to raise new

debt or equity was impaired, and the cash shortage caused cancellation or deferral of many new plants. While the situation has improved somewhat in the past year, financial problems are still evident.

Nuclear power

The fuels to generate electricity have shifted in recent years, with the nuclear share of electricity production growing sharply from 4.5 percent in 1973 to about 8.6 percent estimated for 1975 (Figure 2.1.16.5-21). Although nuclear power has the lowest variable operating costs and is insensitive to oil price fluctuations, nuclear plants require the largest capital investment and the longest construction lead time of any type of electric generating plant. Consequently, nuclear plants have been the most heavily affected by recent plant deferrals and cancellations. Since June, 1974, orders for more than 100,000 megawatts of planned nuclear capacity have been canceled or postponed. These cancellations and deferrals amount to almost 70 percent of planned additions. Nevertheless, with the drop in electricity growth and the additions of new plants, reserve capacity is now 34 percent, compared with a traditional level of 20 percent.

Coal

Coal production has remained essentially level during the five-year period from 1970 to 1975 (Figure 2.1.16.5-22). Production in 1970 was 603 million tons; in 1974, it was still 603 million tons; it rose to about 640 million tons in 1975. Coal production could have been higher in 1974, but about 40 million tons of production were lost as a result of work stoppages in that year.

Over the past 20 years, coal consumption has declined in the industrial and residential sectors, while the use of coal as a boiler fuel by utilities has increased. The regulated price for interstate natural gas, the removal of import controls on residual fuel oil and its cheap imported price until the

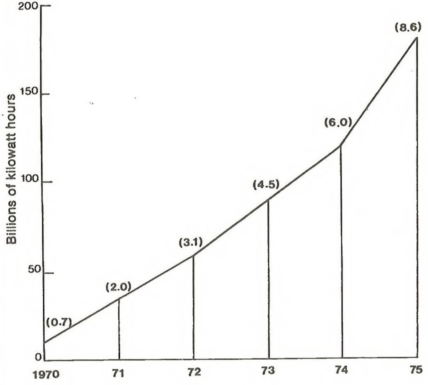


Figure 2.1.16.5-21 Nuclear power generation by year (percentage of total electric power generation)

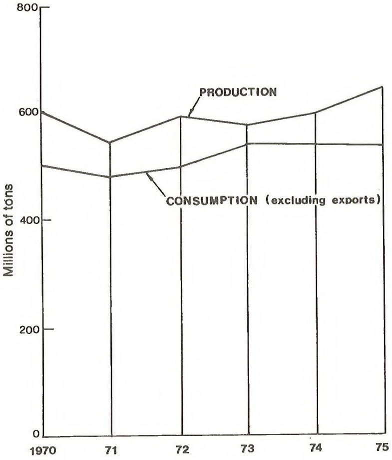


Figure 2.1.16.5-22 Annual U.S. coal production and consumption by year

embargo, and the continued development of nuclear power have limited the growth of coal use. In the late 1960s and early 1970s, state and local air pollution regulations discouraged the burning of coal in many situations. The uncertainty about environmental issues, such as interim use of intermittent control systems, reliability and cost of stack gas scrubbers, litigation over significant deterioration regulations, compliance deadline extensions, legislative changes to the Clean Air Act and surface-mining reclamation laws, is still affecting the growth in coal use.

While oil prices rose dramatically, coal prices for long-term contracts have been relatively stable. Spot coal prices rose rapidly to about $32 per ton in the latter part of 1974 in anticipation of a coal strike, but then declined markedly in 1975 (Figure 2.1.16.5-23). Contract coal prices increased steadily from 1974 to 1976.

West Coast oil refineries

West Coast refineries represent a heterogeneous mix of old and new technology and processes ranging in size from very large to very small. It is impossible to select any one refinery as typical, or any cluster of two or three as representative. On the other hand, a composite refinery implies more flexibility and more capacity than actually exists. The approach used here is the feed-forward logical simulation method. The refineries are calculated as they are actually run, step by step through each process unit in turn. Adjustments are made in individual process unit rates to achieve certain necessary balances.

The probable on-stream efficiency (calendar day average/maximum stream day capacity) for an individual process relates not only to the design of the plant, to the skill of the operator, to ambient conditions, and to the quality and availability of the feed stock, but to exogenous constraints, primarily the demand of the marketplace. The Petroleum Allocation for Defense District (PADD) V crude capacity, as reported by individual

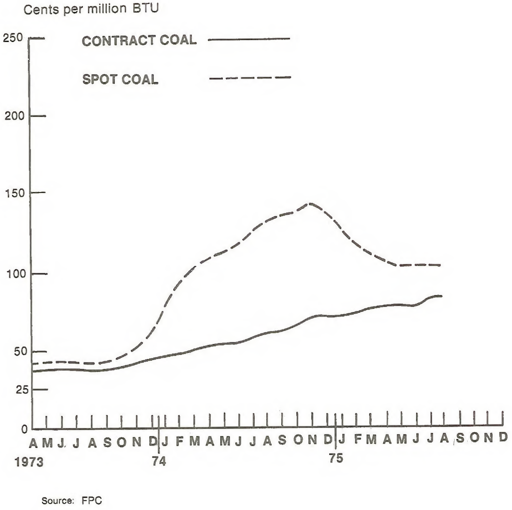


Figure 2.1.16.5-23 Average coal prices (FOB plant) 1973-5

refineries, has been adjusted by applying both an on-stream factor and a combining factor to obtain a composite capacity.

The capacity of individual processing units for the refineries in PADD V has been determined largely from published sources ("Refining and Gas Processing, Worldwide Directory," The Oil and Gas Journal: 1973, 1974; "Annual Refining Survey," The Oil and Gas Journal, 29 March 1976; and "Worldwide HIP Construction Box Score," Hydrocarbon Processing, February, 1976). PADD V used approximately 2 million barrels of oil per day as input to West Coast refineries (Table 2.1.16.5-20), and during 1976 the following crude slate was used:

TYPE	Mbbl/cd
California mix	840
Alaska	191
Canadian	101
Murban	49
Other Mideast	351
Four Corners	24
Venezuela	42
Other South American	55
African	5
Indonesian	272
Lease condensate and others	71

Fuel oil production is proportionately higher for the Los Angeles Basin than in PADD V because of the new Standard Oil (California) low-sulfur fuel oil facility.

Table 2.1.16.5-20

PADD V Refining

PROCESS	Stream Day Capacity (Mbbl)	Maximum On-Stream Efficiency, Percent			Composite Capacity (Mbbl/cd)
		Individual Units	Combining Factor	Overall	
Crude	2,381	96	90	86	2,048
Vacuum distillation	1,035	96	90	86	890
Visbreaking	101	90			91[a]
Fluid coking	71	93			66
Delayed coking	282	94			265
Gas oil thermal cracking	50	90			45
Gas oil hydrocracking	345	93			321
FCC	542	93			504
TCC	36	92			33
Turbine HDS	37	95			35
Dist HDS	252	95			239
Gas oil HDS	0	90			0
Resid, HDS	0	90			0
Cycle oil HDS	19	92			17
FCC feed HDS	0	90			0
Naphtha HDS	474	94			446
Reformer fixed bed	496	92			456
Reformer cyclic	69	94			64
Reformer BTX	5	92			5
Alkylation H SO	96	96			92
Alkylation HF	24	96			23
Isomerization C	12	96			12
Isomerization C -C	13	96			12
Lube oil solv extract	19	96			18

[a] All feed diverted to cokers assuming minimum visbreaking used.

Table 2.1.16.5-20 (Continued).

PROCESS	Stream Day Capacity (Mbbl)	Maximum On-Stream Efficiency, Percent			Composite Capacity (Mbbl/cd)
		Individual Units	Combining Factor	Overall	
Lube oil hydrotreater	13	96			12
Asphalt	87	96			84
Hydrogen reforming	621	93			577
Hydrogen partial oxid	48	90			43

A representative crude was selected from each of the major import areas:

Origin	Average Crude
Nigeria	Bonny Light
Indonesia	Minas
Columbia-Ecuador-Bolivia	Oriente
Mideast	Light Arabian
Murban-Abu Dhabi	Murban
Venezuela	Cueta-Zulia
Canadian	Interprovincial
Alaskan	Cook Inlet
Four Corners (PADD IV)	Aneth

For the south coast, the 1977 crude mix is projected as follows:

TYPE	Mbbl/cd
California mix	614
Mideast	228
Four Corners	24
Venezuela	13
Other South American	54
African	17
Indonesian	198
Subtotal	1,148
Lease condensates and other	21
Total:	1,169

Crude oil consumption was determined by refinery capacities in the area, as modified by estimated on-stream efficiencies. The refineries are projected to operate at 86.4 percent of published stream day capacities.

Local production lease condensates were added to total crude runs in order to supply isobutane for alkylate yields and normal butane for average annual gasoline pool vapor requirements.

North Slope oil will be brought into the Los Angeles area for use by refineries in the basin and possibly the San Joaquin Valley regardless of the SOHIO project. However, it has not been included because of the timing and quantity uncertainties.

Elk Hills will be in substantial production by 1977. This oil has not been included on the assumption that it will be used in the San Joaquin Valley or will flow north to San Francisco refineries. Approximately 1.1 million bbl/cd of products will be produced in the Los Angeles Air Shed in 1977

(Table 2.1.16.5-21). Most of this is gasoline and heavy low-sulfur fuel oil.

Table 2.1.16.5-21

1977 South Coastal Refineries Product Slate

LIQUID PRODUCT	Mbbl/cd	Percent of Refinery Crude Charge to Stills Plus External Butanes
LPG	15.0	1.3
Gasoline	475.1	40.6
JP-4 jet fuel	25.0	2.1
Petrochemical feed stocks	13.8	1.2
Liquid feeds for H manufacture	7.9	0.7
Kerosene, turbine fuel	73.6	6.3
Diesel oil	139.4	11.9
Light low sulfur fuel oil	26.6	2.3
Heavy low sulfur fuel oil	224.6[a]	19.2
High sulfur fuel oil (>0.5%)	78.6	6.7
Asphalt	22.0	1.9
Total	1,096.6	93.8

[a] Fuel oil production.

2.2 FUTURE ENVIRONMENT WITHOUT THE PROJECT

For the purposes of this discussion on the future environment without the project, the description of the environment (Section 2.1) is considered the base from which future trends are projected, to the year 2000. Two assumptions are made in defining the impacts to the year 2000 if the proposed project is not implemented. First, the existing gas pipeline that would be used by the proposed project would remain (see Section 2.2.16.5

which follows). Second, the existing pipeline would be used for the transport of natural gas (or, if modified, for crude petroleum) from Midland, Texas, to California (gas) or from the West Coast to Midland (oil). In the latter case, any additional impacts from the proposed action would be from new construction.

Introduction

The future of the environment without the project is anticipated to remain unchanged in the categories of climate and major terrestrial ecosystems (including such elements as vegetation, wildlife, and soils).

Future use and quality of freshwater resources, for example the Colorado River and/or groundwater aquifers, are largely dependent on land use policies and growth of the urban areas such as Los Angeles (including Orange, Ventura, San Bernardino, and Riverside counties), ability to conserve agricultural areas in producing food and fiber, and proposed industrial projects such as major power plants and transmission lines being considered in California, Arizona, and New Mexico. These projects will require consumptive use of freshwater in the construction and operational phases. In addition to growth requirements in future land and water use, visual intrusions in open space areas will occur as well as impacts on any cultural resources if these or similar proposals are implemented in the future.

Generally, the future environment is dependent on local, state, and Federal use plans, policies, and constraints on land, air, water, and human resources. These policies are based largely on demands generated by large urban areas for water, energy, land, etc. Such demands have impacts on rural or open areas with low population. These areas frequently have significant natural resources necessary for sustaining urban areas. Those elements of the future environment where definite changes will occur without the project are discussed below.

2.2.1 Climate

Based on past records, climate varies considerably with time and could result in changing levels of impacts, especially at Valdez and along the Sea Leg. Current meteorological science does not have a predictive capability; therefore, new climatic effects on the project are speculative.

2.2.2 Major ecosystems

2.2.2.1 Marine

Sea Leg

There should be no significant changes, other than those which naturally occur in the physical and chemical environment which affect the living organisms of the sea, should the proposed action not be implemented. Temperatures, salinities, nutrient concentrations, light intensities, and other related factors should follow their normal cycles in the marine environment.

Since ship traffic already occurs along all or most of the proposed route, any changes to the biotic components would be caused by this existing traffic. Should the proposed action not be undertaken, there would be no foreseeable changes in the life currently existing along the route.

Port of Long Beach area

The Port of Long Beach in San Pedro Bay is a major terminal for imported petroleum products, including large amounts of crude oil. With the development of the Prudhoe Bay area and the North Slope field, great amounts of Alaskan crude oil will come to Long Beach regardless of the construction of the SOHIO pipeline. To accommodate this oil, additional harbor development will occur. Extensive channel dredging and landfills are

contemplated for the outer harbor under various preliminary studies by the Port of Los Angeles and a proposed general plan by the Port of Long Beach. Specifically, the extent of differences between the present and future setting depends upon the amount of dredging, filling, and circulation reduction.

Assuming adoption of the Long Beach Harbor general plan, both abiotic and biotic factors in the harbor will be significantly changed from existing conditions. Circulation and flushing will be extremely modified. Finer sediments will accumulate throughout the harbor. Water quality will be poorer, with lower dissolved oxygen (DO) and higher temperatures. Populations in the outer harbor will resemble present inner harbor communities. The rocky shore and benthic communities will be less diverse. Algae species diversity, zooplankton populations, and fish nursery areas will be significantly reduced. Outer harbor fish populations will be limited to those adapted to restricted channels and shipping lanes. Fish populations in the inner harbor will be transitory because of the below-standard water quality.

Avifauna feeding and resting areas in the harbor will be reduced by extensive landfills or disturbed by increased harbor activity. After landscaping, gains in terrestrial habitat will occur, with possible improvement in species diversity. Further reduced species diversity will occur from catastrophic and incremental oil spills.

Extensive physical changes in the harbor, such as poor circulation, decreased water quality, and reduced species diversity, will be evident.

2.2.4 Soils

2.2.4.1 Port of Long Beach

The future environmental setting without the project will remain essentially the same as it is at present. If the general plan for the Port of Long Beach is implemented, however, there will be a significant alteration of the present marine environment.

Through associated dredging, some pollutants will be removed from the sediments and deposited in approved dumping sites. Therefore, theoretically, unpolluted substrate should be exposed.

The proposed landfills, if developed, will modify energy patterns in both Los Angeles and Long Beach harbors. This will affect the depositional sediment characteristics of the area. If the energy patterns are altered, it is possible that present areas of erosion will become areas of deposition, and vice versa. Also, filled areas could be a potential source of sediments because of the continuous wave action against them.

Decreased circulation and flushing, resulting from implementation of the proposed general plan, will increase the tendency toward accumulations of finer sediments throughout Long Beach Harbor.

2.2.5 Water resources, quality, and use

2.2.5.1 Marine

Sea Leg

The physical environment in the ocean areas of the tanker route as described is not expected to change significantly in the future. Physical parameters such as waves, currents, water temperature, and salinity are governed by the global climatic patterns. Tides in the ocean are governed by the declination of sun and moon and are periodic and predictable. The chemical property of water in the ocean area will likely remain the same in the future. Possible navigational hazards such as icebergs and winds are expected to occur to the same extent, with or without the proposal.

Without the proposal, the transportation of North Slope crude oil from Valdez by tanker would still occur. Thus, adverse impacts to water resources in Prince William Sound and the ocean are expected from occasional oil spills and ship discharges from accidents or operations. Most, if not all, such future degradation of existing water quality would be localized in area and of temporary duration due to natural dilution and dissipation processes.

Port of Long Beach

Future water quality in the Port area without the project depends upon the amount and rate of harbor growth. Implementation of the general plan will reduce tidal circulation and flushing in the harbor. In general, the future outer and middle harbor water quality conditions will tend to approach present conditions in inner Long Beach Harbor.

2.2.6 Introduction

Future air quality without the proposal at Port Valdez cannot be predicted on the basis of studies provided for this document. It can be assumed that oil will move through the port with or without the project. However, no incremental change can be identified at this time.

A separate study (ERT, 1976) is available and discusses, among other technical subjects, the methodology and data used in estimating future air quality along the pipeline project.

2.2.6.1 Los Angeles Air Shed

Projection of emissions

Tables 2.2.6.1-1 through -4 present emissions data for sulfur oxides, particulates, nitrogen oxides, and hydrocarbons for the years 1974, 1980, and 1995, without this proposed SOHIO project. These inventories and projections were compiled by the South Coast-Southeast Desert Air Quality Maintenance Task Force (1976). (Note that the data in Tables 2.2.6.1-1 and -2 are not in full agreement with the inventory in Table 2.1.6.2-4. Also, note that ship emissions are not presented. Refer to the graphical display of hydrocarbon and nitrogen oxide emissions contained in Figures 2.1.6.2-10 through -13.)

Table 2.2.6.1-1

Emissions of Sulfur Oxides in the South Coast Air Quality Maintenance Area

SOURCES	1974 Tons per day	1974 Percent of total	1980 Tons per day	1980 Percent of total	1995 Tons per day	1995 Percent of total
Stationary sources						
Petroleum:						
Production	5.2	1.2	5.3	0.8	6.3	1.4
Refining	77.9	18.0	77.9	12.1	101.4	21.8
Organic solvent users	0.6	0.1	0.7	0.1	0.9	0.2
Metallurgical	41.0	9.5	42.8	6.6	53.1	11.4
Mineral	20.4	4.7	20.9	3.2	26.2	5.6
Combustion of fuels:						
Refineries	11.2	2.6	12.5	1.9	16.2	3.5
Power plants	198.5	45.9	395.8	61.4	164.6	35.4
Other industrial	1.6	0.4	5.3	0.8	5.7	1.2
Domestic, commercial	0.4	0.1	0.4	0.1	0.5	0.1
Orchard heaters	3.4	0.8	3.7	0.6	4.4	0.9
Waste burning	0.6	0.1	0.6	0.1	0.7	0.2
Mobile sources						
Motor vehicles (on road):						
Light-duty vehicle exhaust	19.4	4.5	14.0	2.2	15.8	3.4
Heavy-duty vehicle exhaust	1.3	0.3	1.2	0.2	2.1	0.5
Heavy-duty diesel exhaust	14.7	3.4	19.8	3.1	3.9	0.8
Jet aircraft	4.9	1.1	6.5	1.0	10.6	2.3
Piston aircraft	0.3	0.1	0.5	0.1	0.7	0.2
Railroads	12.5	2.9	15.2	2.4	23.0	4.9
Off-road vehicles	18.7	4.3	21.1	3.3	28.9	6.2
Total	432.5	100%	644.2	100%	465.0	100%
Total relative to 1974 (percentage)	100%		148.9%		107.5%	

Source: Air Quality Maintenance Task Force (AQMTF), 1976.

Table 2.2.6.1-2

Emissions of Particulates in the South Coast Air Quality Maintenance Area

SOURCES	1974 Tons per day	1974 Percent of total	1980 Tons per day	1980 Percent of total	1995 Tons per day	1995 Percent of total
Stationary sources						
Petroleum:						
Refining	3.4	1.2	3.8	1.2	4.9	1.4
Organic solvent users:						
Surface coating	2.1	0.7	2.5	0.8	3.5	1.0
Other	3.7	1.3	4.0	1.2	4.5	1.3
Metallurgical	12.4	4.4	13.2	4.1	16.0	4.5
Mineral	30.5	10.7	33.5	10.4	42.6	11.9
Combustion of fuels:						
Refineries	5.7	2.0	6.4	2.0	8.3	2.3
Power plants	23.0	8.1	55.9	17.3	18.1	5.1
Other industrial	2.8	1.2	5.7	1.8	7.8	2.2
Domestic, commerical	9.2	3.2	9.8	3.0	11.2	3.1
Orchard heaters	1.1	0.4	1.1	0.3	1.4	0.4
Waste burning	1.3	0.5	1.5	0.5	1.7	0.5
Miscellaneous area sources	66.0	23.2	73.1	22.7	92.2	25.8
Mobile sources						
Motor vehicles (on road):						
Light-duty vehicle exhaust	82.3	30.0	60.3	18.7	52.2	14.6
Heavy-duty vehicle exhaust	4.2	1.5	4.0	1.2	5.0	1.4
Heavy-duty diesel exhaust	9.7	3.4	11.5	3.6	16.4	4.6
Motorcycle exhaust	0.4	0.1	0.3	0.1	0.4	0.1
Jet aircraft	14.1	5.0	19.1	5.9	48.5	13.5
Piston aircraft	2.4	0.8	4.0	1.2	5.4	1.5
Railroads	0.8	0.3	1.0	0.3	1.7	0.5
Off-road vehicles	8.8	3.1	12.1	3.7	16.5	4.6
Total	284.3	100%	322.7	100%	358.2	100%
Total relative to 1974 (percentage)	100%		113.5%		125.9%	

Source: AQMTF, 1976.

Table 2.2.6.1-3

Emissions of Nitrogen Oxides in the

South Coast Air Quality Maintenance Area

SOURCES	1974 Tons per day	1974 Percent of total	1980 Tons per day	1980 Percent of Total	1995 Tons per day	1995 Percent of total
Stationary sources						
Petroleum:						
Production	3.1	.02	3.1	.03	3.5	0.4
Refining	18.8	1.3	21.1	1.8	27.3	2.8
Marketing	10.3	0.7	4.1	0.4	2.1	0.2
Organic solvent users	1.5	0.1	1.8	0.2	2.3	0.2
Metallurgical	26.2	1.8	27.4	2.4	33.8	3.5
Mineral	28.1	2.0	32.7	2.8	38.5	4.0
Food and Agric. Processing Combustion of Fuels	0	0	1.0	0.1	1.4	0.1
Refineries	47.9	3.4	53.6	4.6	69.5	7.2
Power plants	121.2	8.5	186.0	16.1	80.6	8.4
Other industrial	47.9	3.4	84.5	7.3	115.8	12.0
Domestic, commercial	55.8	3.9	59.1	5.1	67.2	7.0
Orchard heaters	0.9	0.1	0	0	0	0
Waste burning	5.1	0.4	5.2	0.5	5.6	0.4
Misc. area sources	3.7	0.3	3.7	0.3	4.3	0.4
Mobile sources						
Motor vehicles (on road):						
Light-duty vehicle exhaust	634.0	44.4	290.1	25.1	124.5	12.9
Heavy-duty vehicle exhaust	52.0	3.6	37.0	3.2	22.9	2.4
Heavy-duty diesel exhaust	196.6	13.8	140.8	12.2	91.0	9.4
Motorcycle exhaust	0.1	0	0.1	0	0.3	0
Jet aircraft	12.9	0.9	17.4	1.5	16.4	1.7
Piston aircraft	4.0	.03	6.2	0.5	9.2	1.0
Railroads	29.2	2.0	34.8	3.0	50.6	5.2
Off-road vehicles	127.9	9.0	144.4	12.56	198.1	20.5
Total	1,427.2	100%	1,154.1	100%	965.0	100%
Total Relative to 1974 (percentage)	100%		80.9%		67.6%	

Source: AQMTF, 1976.

Table 2.2.6.1-4

Emissions of Total Hydrocarbons in the South Coast Quality Maintenance Area

SOURCES	1974 Tons per day	1974 Percent of total	1980 Tons per day	1980 Percent of total	1995 Tons per day	1995 Percent of total
Stationary sources						
Petroleum:						
Production	61.2	3.8	62.1	5.4	67.9	5.7
Refining	47.9	3.0	53.4	4.6	69.2	5.8
Marketing	154.2	9.6	62.4	5.4	36.7	3.1
Organic solvent users	408.8	25.6	458.4	39.7	597.8	5.0
Metallurgical	2.8	0.2	2.9	0.3	3.7	0.3
Mineral	1.0	0.1	1.0	0.1	1.3	0.1
Pesticides	9.1	0.6	11.0	1.0	13.9	1.2
Combustion of fuels:						
Refineries	5.4	0.3	6.0	0.5	7.8	0.7
Power plants	8.4	0.5	14.1	1.2	5.7	0.5
Other industrial	3.1	0.2	5.6	0.5	7.2	0.6
Domestic, commercial	1.2	0.1	1.3	0.1	1.8	0.2
Orchard heaters	4.1	0.3	4.4	0.4	5.3	0.4
Waste burning	2.1	0.1	2.3	0.2	2.7	0.2
Miscellaneous area sources	64.4	4.0	67.3	5.8	74.2	6.2
Mobile sources						
Motor vehicles (On road):						
Light-duty vehicle exhaust	413.1	25.8	133.4	11.6	47.1	3.9
Heavy-duty vehicle exhaust	48.9	3.1	31.7	2.7	3.5	0.3
Heavy-duty diesel exhaust	19.8	1.2	15.7	1.4	9.1	0.8
Motorcycle exhaust	23.2	1.3	22.2	1.9	3.8	0.3
Evaporation	194.6	12.2	48.3	4.2	37.6	3.1
Jet aircraft	19.1	1.2	25.1	2.2	34.0	2.8
Piston aircraft	13.4	0.8	20.8	1.8	20.0	1.7
Railroads	6.6	0.4	8.0	0.7	11.6	1.0
Off-road vehicles	86.3	5.4	97.0	8.4	132.7	11.1
Total	1,598.7	100%	1,154.4	100%	1,194.6	100%
Total relative to 1974 (percentage)	100%		72.2%		74.7%	

Source: AQMTF, 1976.

Total particulate emissions in the Los Angeles Air Shed increase throughout the period from 1974 to 1995. The light-duty vehicle exhaust emissions, which were the largest particulate source category in 1974, decrease in the projection period, but the decrease is offset by increases mainly in the fuel combustion, mineral, and miscellaneous area source categories.

Sulfur dioxide (SO_2) emission totals increase between 1974 and 1980, and decrease below 1974 levels after 1995. The major source contributing to this SO trend is the power plant fuel combustion category. Power plant SO emissions (46 percent of the total in 1974) contribute 61 percent in 1980 due to fuel conversions from natural gas to oil. The power-plant fraction drops to 35 percent of the total in 1995 as more electrical power is brought in from areas outside of the Los Angeles Basin.

According to the inventory projections, hydrocarbon (HC) and nitrogen oxide (NOx) emissions will decrease over the next decade as newer, less polluting cars are produced. The downward trend in hydrocarbon emissions will then reverse as the number of cars and new industrial sources mount. On the average, oxidant levels are roughly proportional to HC emission rates. Whether the trend toward renewed air quality degradation materializes in the 1990s, or whether the projections are inaccurate, remains to be seen.

Future ambient air pollutant concentrations

Sulfur dioxide. Figure 2.2.6.1-1 indicates that maximum 24-hour average SO_2 concentrations in 1980 will be located in a band between Long Beach and Whittier. The peak value (18 pphm) will occur near Long Beach. Projected concentrations for the year 2000 (Figure 2.2.6.1-2) will decrease in most areas to 1974 levels; maximum (near Long Beach) is estimated at 12 pphm.

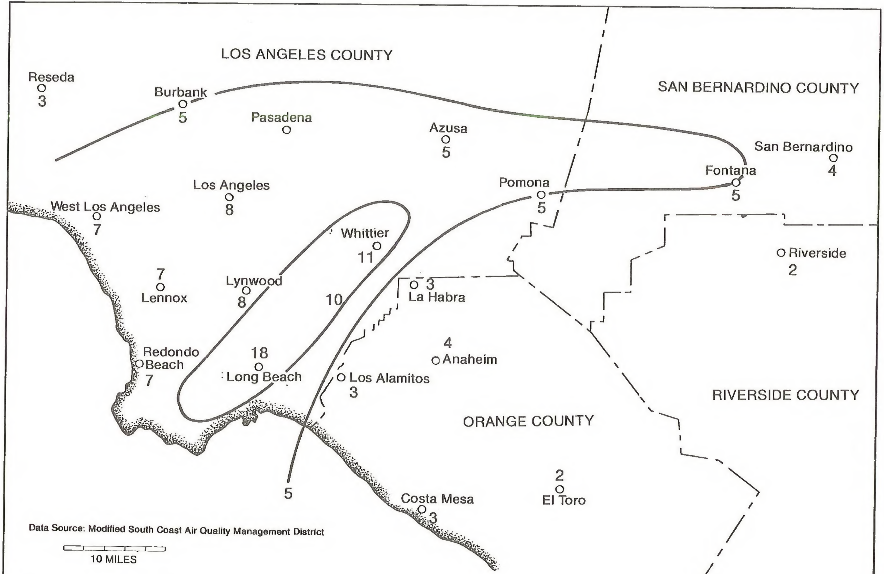


Figure 2.2.6.1-1 Maximum 24-hour SO_2 concentrations (pphm), without project, 1980

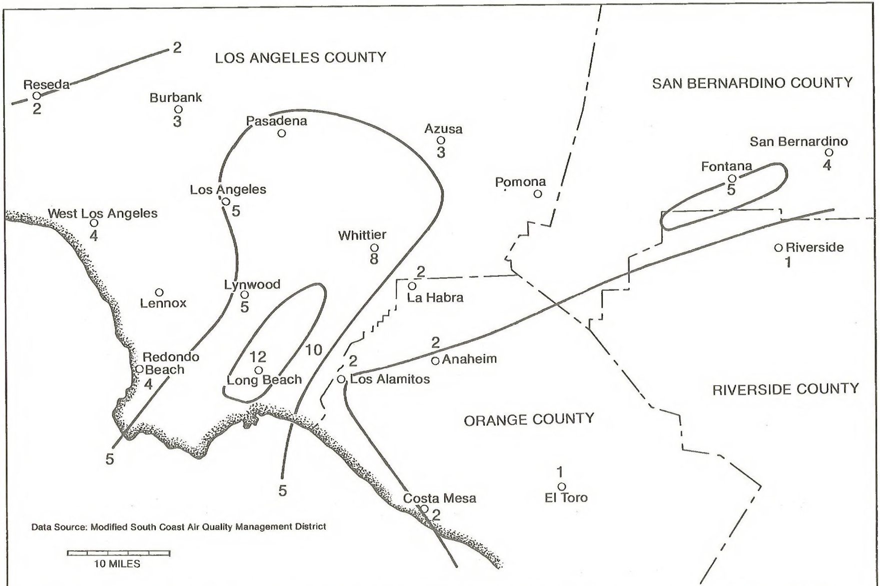


Figure 2.2.6.1-2 Maximum 24-hour SO_2 concentrations (pphm), without project, 2000

Total suspended particulates. TSP emissions increase over the projection period. The projected inventories for 1980 and 1995 indicate that though particulate emissions from light-duty vehicles decrease, emissions from the fuel-combustion and miscellaneous-area source subcategories offset these reductions. Maximum 24-hour average TSP concentrations projected for 1980 and 2000 (Figures 2.2.6.1-3 and 2.2.6.1-4) follow a pattern east and west in the basin with concentrations decreasing from 1974 to 2000 in Orange and Riverside counties and increasing in Los Angeles and San Bernardino counties. The maximum daily average concentrations in both projection years are above applicable standards.

Oxidant. Oxidant levels are a complex function of hydrocarbon and NOx levels in conjunction with various meteorological factors. Oxidant levels, in essence, are enhanced when these two pollutants (among others) are concentrated for at least three hours in the presence of sunlight.

Computer modeling is the most reliable method of estimating oxidant levels. Oxidant concentrations downwind from Long Beach for no-project in the years 1980 and 2000 are discussed in Section 3.1.6.1.2.

2.2.6.2 Pipeline route

Air quality along the pipeline route outside of the Los Angeles Air Shed will not change significantly from 1974 levels. The Air Quality Maintenance Areas (AQMA) near the pipeline route, listed in Section 2.1.6.3, are:

1. Portions of San Bernardino and Riverside counties in California for TSP and oxidants.
2. Phoenix (Maricopa County), Arizona, for TSP, CO, and oxidants.
3. Tucson (Pima County), Arizona, for TSP and oxidants.
4. Dona Ana County, New Mexico, for TSP and CO.
5. El Paso County, Texas, for hydrocarbons.

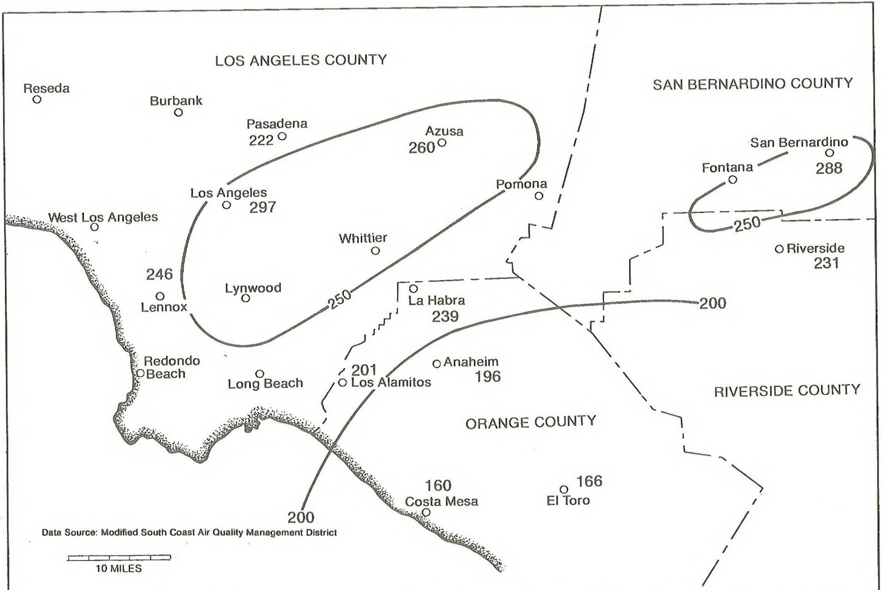


Figure 2.2.6.1-3 Maximum 24-hour TSP concentrations ($\mu g/m^3$), without project, 1980

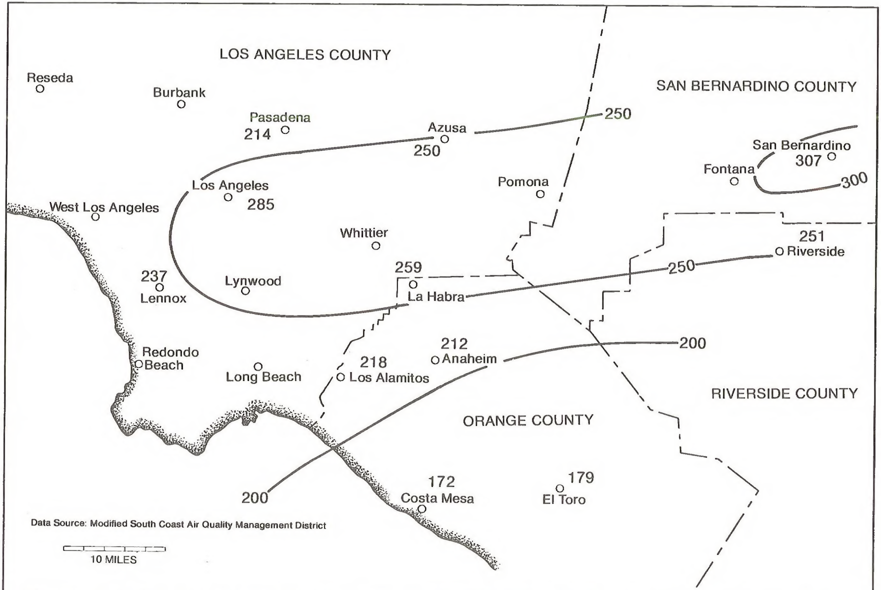


Figure 2.2.6.1-4 Maximum 24-hour TSP concentrations (µg/m³), without project, 2000

At the current time, AQMA work is being performed by the states, but the plans have not been submitted to the EPA. Some improvement in air quality in populated areas is expected to accompany air quality maintenance planning, but this is not expected to significantly change ambient air quality near the pipeline.

The preliminary emissions inventory and forecast developed for the South Coast-Southeast Desert AQMA (AQMTF, 1976) gives some insight into possible trends. In southeastern California they project a 71 percent increase by 1985 in emissions of SO_2, to 71.5 tons per day, because of growth in the metallurgical industry. The other major increase in SO_2 emissions will result from expansion of electrical power production. Estimates from the Air Quality Maintenance Task Force indicate a rise from 0.2 to 13.1 tons per day. From all sources, the Task Force projects an 86 percent growth in SO emissions to 96.7 tons per day by 1995. This projected level is 22 percent of the 1974 SO_2 emissions level in the South Coast Air Quality Maintenance Area. Similarly, they project a 36 percent rise in primary particulate emissions. The largest increments are from expanded farming operations (from 9.6 to 16.1 tons per day) and expanded minerals extraction (from 7.5 to 12.8 tons per day).

As a consequence, national and state TSP standards will continue to be violated in southeastern California (Table 2.1.6.5-1). The same conclusion can be made in the other states along the pipeline. Violation of SO_2 standards in Arizona can be expected, unless very vigorous efforts at abatement are mandated.

Oxidant levels near the pipeline should remain near background levels. Levels in urban areas should decrease slightly. (The southeast California emissions inventory cited above projects a 34 percent drop in nonmethane hydrocarbons and a 20 percent increase in nitrogen oxides emissions.)

2.2.6.3 Midland and vicinity

The Midland-Odessa area should experience little change in air quality over the projection years from that of 1974. Annual TSP concentrations in the projection years may be above the National Secondary Standard. Concentrations of TSP, over 24-hour averaging periods, and NO_2 over all periods, should be below all applicable standards. Oxidant levels in Odessa, which were well above the 160 $\mu g/m^3$ standard in 1974, will probably remain high.

2.2.6.4 Air quality standards

No changes in national or state air quality standards are expected. Air quality maintenance and attainment procedures, however, are expected to evolve.

In Section 2.1.6.5, new source review rules are discussed. They comprise a procedure, administered at the local level in California, to ensure that major new or modified air polluting sources will not interfere with the attainment or maintenance of any state or national ambient air quality standard. On a broader level, the EPA (Federal Register, 1974) has promulgated additional restrictions on resultant ambient concentrations from new sources to prevent significant air quality deterioration. By this system, each area of the country can be designated as a specific category in terms of air quality. Class I areas are impacted ones in which any increase in ambient concentrations is considered significant. Class II areas are those in which deterioration accompanying moderate controlled growth is considered tolerable. Class III areas are those in which deterioration up to the standards is considered tolerable. All areas are classified as Class II regions by the EPA. The states may redesignate areas as Class I or Class III. No areas near the pipeline east of California are anticipated to be redesignated from Class II.

Table 2.2.6.4-1 gives the maximum increases in ambient concentration ($\mu g/m^3$), allowed by the EPA, for SO_2 and TSP. As soon as this increase is reached, no new or old sources may produce additional emissions. The U.S. House of Representatives has been considering more restrictive legislation.

Table 2.2.6.4-1

Maximum Allowable Increases in

Ambient Concentrations ($\mu g/m^3$)

POLLUTANT MEASUREMENT	Class I	Class II
Sulfur dioxides:		
Annual	2	15
24-hour	5	100
3-hour	25	700
Total suspended particulates:		
Annual	5	10
24-hour	10	30

Source: Federal Register, 1974.

2.2.7 Vegetation

2.2.7.1 Marine

Sea Leg

The productivity of phytoplankton and kelp beds should not be affected in the absence of the proposed action. Photosynthetic activity and community structure should be unaltered, with the exception of those changes brought about through natural phenomena.

Port Valdez area

Port Valdez, Port Valdez Arm, and Prince William Sound will be the beginning of a tanker route, if not to Long Beach, then to some other port. Therefore, the future environment of these areas, or adjacent estuaries/deltas (Copper River, for example) without this project is likely to be a change from an essentially undeveloped to a developed port area.

Port of Long Beach

The docking facility, Pier J, is part of the Port of Long Beach general plan and will be built regardless of enactment of this proposal.

The following general discussion is based upon a future outer harbor modification by landfills and channel dredging as generally envisioned under preliminary harbor expansion studies by the Port of Los Angeles and the proposed general plan of the Port of Long Beach.

Phytoplankton. It is expected that future phytoplankton population and productivity within the harbor will be reduced if the channel dredgings and extensive fills envisioned for outer harbor areas are completed.

Algae. A restriction in water circulation will result from channel dredging and extensive fill in the outer harbor. It is quite possible that outer harbor conditions will shift toward conditions ordinarily found in the present inner harbor (AHF, 1975). A general reduction in algae species diversity would be expected with this change.

2.2.7.2 Pipeline route

Should the proposed project not be implemented, the gas pipelines now proposed for conversion to oil pipeline may remain in service as natural gas pipelines. Because of declining Permian Basin gas supplies, other, older gas pipelines of the El Paso system to Los Angeles might be abandoned.

2.2.8 Wildlife

2.2.8.1 Marine

Sea Leg

The activities of animals along the proposed marine route should not be altered in the absence of the project. Unless interspecific activities such as competition and predation change, or other human activities become more demanding of the marine system, no other changes in these communities can be foreseen.

Port of Long Beach

Zooplankton. The harbor's zooplankton population will be decreased from present conditions and future developments regardless of the implementation of the proposed project simply because much of the open water area will be absorbed by filling (AHF, 1975). As previously mentioned, channel dredging and extensive landfills in the outer harbor will create conditions ordinarily found in the inner harbor. Species of zooplankton such as *Acartia tonsa* and *Oithona oculata*, presently dominant in the inner harbor, will become dominant species in the new channels and basins created in areas of the outer harbor (AHF, 1975).

Water column and settling organisms. The landfills envisioned for the outer harbor will reduce tidal circulation. A reduction in tidal circulation will create lower dissolved oxygen (DO) and higher water temperatures. The high stress areas delineated by the Allan Hancock Foundation (see Table 2.1.8.1.3-5) will probably extend into the outer harbor in response to limited water circulation (AHF, 1975).

Benthic fauna. The future setting will contain an outer harbor significantly reduced in benthic habitat. Approximately 30 percent of Long Beach Harbor benthic habitat is envisioned as fill area. An estimated 230 metric tons of biomass will be lost as a result of construction of landfills under the Port of Long Beach proposed general plan (Port of Long Beach, 1976). The future outer harbor benthic habitat will contain benthic communities presently found within inner harbor areas which are of lower species diversity. Benthic communities in parts of the inner harbor may be less diverse than at the present time. When considering envisioned and proposed fills in both ports, areas such as AHF's benthic Groups Y and Z (see Figure 2.1.8.1.3-10) could possibly be void of benthic infauna (AHF, 1975).

Rocky shore fauna. The large landfills envisioned for the outer harbor by the Port of Long Beach will cause a significant reduction in fetch area (Port of Long Beach, 1976). A reduction in fetch area will result in less short-period waves being generated in the outer harbor. The landfills will also create a significant reduction in tidal circulation (Port of Long Beach, 1976). Throughout the harbor, reduction in wave exposure and tidal circulation will create a future rocky shore community less diverse than at present. Faunal species associated with present inner harbor conditions (e.g., *Balanus amphitrite*) will have extended their dominance and areal distribution throughout the harbor complex.

San Pedro Bay fish populations. Implementation of the Port of Long Beach General Plan will significantly reduce the soft-bottom fish fauna, both in total numbers and number of species (AHF, 1975). Succeeding populations will resemble the Cerritos Channel fish fauna, which is lower in number and species (AHF, 1975). Adult sport fish populations in Long Beach Harbor will be about 50 to 80 percent less than at present. The inner harbor will have only a transient fish population because of poor water quality (Port of Long Beach, 1976). The families Gobiidae, Sciaenidae, and Embiotocidae will probably dominate the total fish population because of their adaptations to restricted channels and shipping lanes (AHF, 1975). Rock revetments and jetties will attract such species as bay goby, white and shiner perch, black croaker, white croaker, and queenfish. Northern anchovies will still be present, although population reductions of from 50 to 75 percent are expected (Port of Long Beach, 1976).

Many of the anchovies in the harbor represent juveniles of those caught commercially after they migrate to coastal waters. Altered harbor configurations, the result of new fills, slips, and channels, will reduce tidal circulation. Flushing actions maintain water quality and introduce fish larvae and eggs into the harbor; consequently, reduced flushing and the resultant poor water quality will destroy the nursery function of the harbor (Port of Long Beach, 1976).

2.2.8.2 Pipeline route

For the purposes of this discussion, the description of the existing wildlife environment (Section 2.1.8) is considered as the base from which future trends may be projected. Two assumptions are made in defining the impacts on wildlife to the year 2000 if the proposed project is not implemented. First, the existing pipeline that would be used by the project would remain in place. Second, the existing pipeline will be used for the transport of either natural gas or crude petroleum, as noted previously.

Therefore, any additional impacts to wildlife from the proposed action would be the result of any new construction.

Historically, southern California has exhibited extensive population growth. Accompanying this growth has been the conversion of undisturbed lands into agricultural and urban areas. This conversion has resulted in the elimination of extensive areas of wildlife habitat. Growth, and hence conversion, has been most dramatic from Los Angeles to Palm Springs. At present, there appears to be no reason why this trend should not continue. Increased environmental concern in southern California will probably lead to the formation of additional nature preserves and wildlife refuges which may serve to preserve endangered populations of animals which were formerly abundant. As urbanization and agricultural expansion increase, animals considered as pests or health hazards (e.g., black rat, _Rattus rattus_) may be expected to increase in density, because they typically are associated with human habitation.

Population growth in the Colorado Desert, specifically from Palm Springs to Blythe, has been limited by the scarcity of water. Agriculture has been limited to those areas where water is available, such as the Palo Verde Valley along the Colorado River. Further population growth and agricultural expansion, followed by further wildlife habitat reductions, are not expected in the Colorado Desert unless a new water resource becomes available there. There already has been extensive local destruction of desert wildlife habitat because of altered drainage patterns created by previous construction activities in this desert. Based on the projection to the year 2000, this habitat loss may be considered permanent since recovery of desert ecosystems is extremely slow. Additional habitat destruction and losses of wildlife are expected as more people from large urban centers utilize vast areas of the desert for recreational purposes. Off-road vehicle (ORV) activity in the desert has increased dramatically in recent years, resulting in direct and indirect wildlife destruction. Unless more direct measures

are taken to restrict ORV activity to specified areas, widespread losses of habitat and wildlife may be expected.

Without additional water, by either irrigation or discovery, little change in species distribution or range is anticipated in any of the deserts in California, Arizona, New Mexico and Texas. Except for a few species, such as predatory mammals, raptorial birds, and animals whose existence is already threatened by human encroachment, most wildlife populations will remain relatively stable.

2.2.8.3 Rare or Endangered species

The Endangered brown pelican would be displaced from open-water feeding areas of the outer harbor without the SOHIO proposal. In association with the Port of Long Beach proposed general plan, the Endangered California least tern might well be accommodated in a tank-storage area that will have little human traffic if a sandy soil area for nesting and a freshwater pond are provided (Port of Long Beach, 1976). If provisions are not made to guard and create nesting and feeding habitats for this species, the future setting will hold little place for them. Even if such provisions are made, they will not necessarily assure utilization by this species.

As the urban population continues to expand outward from the Los Angeles metropolitan area, those wildlife species presently having protective designation will undoubtedly suffer further population reduction. If this trend continues, more species will almost certainly be added to the Rare or Endangered lists.

2.2.10 Visual resources

2.2.10.1 Long Beach

The California Coastal Act of 1976 requires that scenic and visual qualities of coastal areas be considered and protected. The Act further requires local governments to bring their general plans, master plans, land-use plans, zoning ordinances, zoning district maps, and implementing actions for the coastal zone into accordance with the provisions and policies of the act by 1979.

Presumably the visual policy guidelines of the California Coastal Plan (1975) will apply to the Long Beach General Plan and Port of Long Beach Master Plan, which should ensure at least maintenance of present visual quality within the Port and San Pedro Bay and may encourage enhancement of presently degraded areas through landscaping and painting of existing industrial facilities and removal of inventory storage facilities that are not coastally dependent.

2.2.10.2 Greater Los Angeles urban landscape

Further visual deterioration of this landscape will result from the continued development of agricultural and open space lands, although some open space lands will be preserved, perhaps as regional parks. Increased emphasis on landscape beautification will soften the visual impact of new developments, and urban renewal projects will enhance some degraded areas.

2.2.10.3 Rural and natural landscapes

Management of national resource lands in the California Desert, Arizona, and New Mexico will increasingly emphasize protection and enhancement of visual resources, which should at least abate visual degradation. However, portions of the pipeline corridor will no doubt be given strong

consideration for rights-of-way for high voltage overhead electrical transmission lines, in conjunction with both nuclear-powered and coal-fired electrical generating plants in California, Arizona, and New Mexico. If approved, these proposals will have significant adverse impacts on the scenic quality and open space values of the lands traversed by the pipeline.

There are no Federal multiple-use lands in western Texas. State lands in western Texas are managed for revenue, not multiple use; therefore, further visual encroachment on scenic and open-space values in Texas can be expected; however, the vastness of the Texas landscape will ensure for the foreseeable future that many scenic and open-space areas remain unspoiled.

2.2.12.3 Recreation and recreational values

San Pedro Bay

Expansion of the Port of Long Beach, according to the Port Master Plan, will reduce the water surface acreage available for boating and boat fishing within San Pedro Bay. Development of marinas and parks by the City of Long Beach east of the port within San Pedro Bay will also decrease the water surface acreage, but berthing facilities will enable more people to pursue boating, and parks will add to shoreline recreational opportunities.

Los Angeles River-Rio Hondo channels

Trails. Future recreational development plans, involving both local agencies and the Corps of Engineers, include installation of a bicycle trail from Palm Beach Park at the mouth of the Los Angeles River to Willow Street and connecting with the existing trail running north from Willow Street. This trail will be on the paved eastern levee of the river. Improvements will be made to the existing bicycle path between Willow Street and Imperial Highway. A new bicycle path will be constructed northward from Imperial Highway utilizing the paved service road on the eastern levee of the Rio

Hondo. The Corps of Engineers and local agencies will also jointly make improvements in the equestrian trail along the channels. Ultimately, this recreational development will result in a continuous bicycle trail from San Pedro Bay to Whittier Narrows Dam and a continuous equestrian trail from Willow Street to beyond Whittier Narrows Dam. (For more detailed information on future trail development, see Rio Hondo Channel and Los Angeles River Recreation Master Plan, Los Angeles District, Corps of Engineers, 1976.)

Whittier Narrows Dam area

Parks. Streamland Park, situated at the downstream base of the dam, will contain picnic areas, a road, tennis courts, multipurpose courts, a swimming area, and baseball diamonds. This area is being developed jointly by the City of Pico Rivera and the Corps of Engineers.

Continuing future construction at the equestrian area will include numerous facilities for equestrians, restrooms, stables, roads, and parking areas. (For more detailed information on recreational developments at Whittier Narrows Dam, see Revised Recreation Master Plan for Whittier Narrows Flood Control Reservoir, Los Angeles District, Corps of Engineers, 1974.)

Trails. The existing bicycle trail running up the San Gabriel River channel and over the dam will be extended northward into the reservoir areas. No other new trail development is anticipated in the near future at Whittier Narrows Dam.

Puente Hills

Portions of the Puente Hills in San Bernardino County may become a regional park, based on a proposed study by the Southern California Council of Governments and the Bureau of Outdoor Recreation.

San Timoteo Canyon

Portions of this canyon may be included in future regional parks of San Bernardino and Riverside counties, based on open space portions of their land-use plans.

California Desert

The Bureau of Land Management Organic Act of 1976 requires that the California Desert Plan be completed by 1979. This plan will update the 1974 Interim California Desert Vehicle Program. It is likely to result in more areas being closed to vehicle use or in vehicles being restricted to designated roads and trails, based on resource inventories that identify fragile or unique environments. An increased number of Desert Rangers should make enforcement of vehicular closures and restrictions more stringent.

Arizona and New Mexico

As the Bureau of Land Management completes its planning studies, off-road vehicle closures and restrictions are likely in fragile environments.

2.2.14 Transportation networks

2.2.14.1 Marine

Sea Leg

The current routes used for marine transportation are determined by physical factors such as bathymetry, storm patterns, etc., that affect the vessel safety or economics of operation. Since the physical features change very slowly it is unlikely that the present route will be altered because of natural changes in the environment. It is possible, however, that as the

means for observation and control of shipping improve, international agreements could alter the concept of "freedom of the seas." This could lead to establishment of voluntary or nonvoluntary methods of limiting ship traffic to prescribed routes or lanes. The most likely outcome would be an extension of vessel traffic system lanes to cover ocean areas. The specific details of such arrangements cannot be predicted at this time.

Improvements in personnel training and more stringent licensing of shipboard personnel represent significant factors in future marine transportation. Training would include use of ship simulators to improve shiphandling and collision-avoidance skills, development of strong awareness of need for pollution control, and improvement in damage control and fire-fighting capabilities. More stringent licensing practices could include requirements for training before advances in grade, periodic requalification, and more definition in regard to licenses required for ship size and type.

Other future improvements that can be expected regardless of the implementation of this project are more and better navigational aids, improved communication systems, better vessel control devices, and a larger proportion of hulls that can limit the loss of oil as the result of an accident.

Port of Long Beach

Ship arrivals to the Port of Long Beach are estimated to increase from 2,870 per year at the present time to 4,150 per year by the year 2000, an increase of about 45 percent. Based on no appreciable change in ship movement patterns, this increase would be 1,280 vessel movements per year with as many as 12 on a peak day.

Completion of the Port of Long Beach Master Plan by that year will cause average daily motor vehicle traffic in the port to increase by 12,500 vehicles, and directional peak-hour traffic will increase by 3,000 vehicles

per hour. Other planned projects in the areas adjacent to the Port of Long Beach, including extensive redevelopment plans by the City of Long Beach, will cause a total additional traffic increase of 238,400 vehicles per day by the year 2000. These vehicles will be using the same access streets and highways that service the Port of Long Beach (Port of Long Beach, 1976).

The Port of Long Beach expects the widening of the Long Beach Freeway and extension of the Terminal Island Freeway to relieve the ensuing intolerable traffic conditions. The traffic demands on port access routes would otherwise exceed available capacities by more than 100 percent at most locations.

The estimated ocean-borne commerce shipped through the Port of Long Beach will have doubled by the year 2000 if the general plan is implemented. This increase will require the development of additional cargo-handling modules for containers and general, petroleum, liquid, and dry bulk cargoes. With the exception of petroleum, which is transported on land via pipeline systems, the remaining cargo will have to be transported from the port to its market area by rail or truck. Assuming no change in the current method of transporting port-related cargo, both rail and truck movements would approximately double in volume. The main-line rail system serving the port has ample capacity to accommodate this increase in demand (about 100 rail cars per day on an average day). Long-range plans provide for the necessary terminal facilities to meet future Port developments.

2.2.14.2 <u>Pipeline route</u>

Crude production from the Permian Basin in Texas and New Mexico is expected to reach a maximum of 2.01 million bbl/d in 1976 and then decline to 940,000 bbl/d in 1985 (DeGloyer and MacNaughton, 1975). The pipeline capacity leaving Midland is 2.01 million bbl/d. Due to the decreasing production and slightly increased refining capacity in the Midland area (9 percent between

1978 and 1985), there will exist an excess capacity of 459,000 (1978) to 1,263,000 (1985) bbl/d in the pipeline leaving Midland.

2.2.15 Utility networks

2.2.15.1 Long Beach Port and terminal area

Water usage in the Los Angeles/Long Beach area by the year 2000 is expected to increase by a factor of about 1.27 over 1975 levels. This will result from population growth.

Electric power demand in the Long Beach/Los Angeles area probably will not increase in direct proportion to population because industrial expansion is projected to slow in the area as a result of environmental problems.

2.2.15.3 Midland

In an environment with or without the project, the exhaustion of the Permian Basin oil will have a profound effect upon the activity of the Midland-Odessa area. It is expected that population could decrease as a result of lack of employment in the oil production and transportation industries. Water and electric power consumption will decrease, but not in proportion to population, because the petrochemical and the refining industries will continue to be active, even with the necessity of importing crude oil from the Gulf area.

2.2.16 Socioeconomic conditions

Projection categories of socioeconomic factors for Bureau of Economic Analysis Areas (BEAA) and Standard Metropolitan Statistical Areas (SMSA) include population, employment, and personal earnings by industry.

Based on the projections of the BEA, total employment is projected to increase at a faster rate than the total population for the Los Angeles-Long Beach, Tucson, Phoenix, and El Paso areas (Table 2.2.16-1). For each of the metropolitan centers (Table 2.2.16.1), the increased earnings per worker range from 51.4 to 56.6 percent by 1990 and from 207.8 to 231.3 percent by 2020. Total earnings for the areas would increase approximately 106 percent by 1990 and 428 percent by 2020. Examined separately, construction growth is predicted to remain in the middle range of the nine industrial categories listed according to percent dollar increase. Each metropolitan area has its distinct ranking for these industries, but agriculture, forestry, fisheries, mining, and wholesale and retail trades are found in the lower levels of percentage increases by 1990 and 2020, and services, finance, insurance, and real estate in the higher levels.

2.2.16.5 Energy supply and demand

With traditional sources of natural gas supply to southern California declining more rapidly than expected, new avenues are being pursued to supplement or replace these historic supplies.

There has been no indication from the applicant or El Paso Natural Gas Company that salvage of the existing pipeline would be considered at some time in the future. It is unlikely that salvage would take place unless the United States was experiencing a critical need for steel.

Should the pipeline which is proposed for conversion to oil transport not be converted because this project goes unimplemented, its use could be: (1) discontinued entirely (although line remains in the ground); (2) continued with use at greater capacity than at present because of new developments from Oklahoma, Texas, or the Gulf of Mexico, or (3) continued because of greater availability of Permian gas supplies that might be liberated by the flow of Arctic gas to the Midwest. It is also possible that, without implementation of this proposed project, but with flow of Prudhoe Bay (or

Table 2.2.16-1

Selected Socioeconomic Indicators for Standard Metorpolitan Statistical Areas

and Bureau of Economic Analysis Areas Related to Proposed Pipeline

SMSA	Long Beach, CA 1980	Long Beach, CA 1990	San Beroardino-Ontario, CA 1980	San Beroardino-Ontario, CA 1990	Phoenix, AZ 1980	Phoenix, AZ 1990	Tucson, AZ 1980	Tucson, AZ 1990	El Paso, TX 1980	El Paso, TX 1990	Midland, TX 1980	Midland, TX 1990	Odessa, TX 1980	Odessa, TX 1990
Population, midyear	7,707,600	8,481,000	1,327,100	1,481,400	1,288,700	1,625,100	426,500	503,900	342,500	360,100	62,800	64,000	87,600	89,900
Per capita income (1967$)	5,831	7,357	4,261	5,544	4,554	5,708	4,279	5,460	3,759	4,914	5,241	6,623	4,396	5,654
Per capita income relative (U.S.=1.00)	1.22	1.19	.89	.90	.95	.93	.90	.89	.79	.80	1.10	1.07	.92	.92
Total employment	3,453,100	3,786,800	519,700	586,100	537,700	661,800	164,400	193,300	132,700	140,100	27,500	27,800	37,300	38,100
	In Thousands of 1967 Dollars													
Total personal income	44,943,600	62,398,100	5,655,100	8,213,400	5,809,400	9,276,000	1,825,100	2,751,600	1,287,800	1,770,100	329,200	424,200	385,100	508,500
Total earnings	36,667,200	50,232,200	4,011,800	5,827,900	4,755,700	7,407,300	1,343,600	2,018,300	1,066,100	1,441,700	257,900	328,700	299,700	391,700
Agriculture, forestry and fisheries	135,600	152,800	155,000	174,600	129,800	144,000	5,800	6,800	11,300	11,000	2,900	3,100	(S)[a]	(S)
Agriculture	127,600	143,800	154,800	174,400	129,500	143,700	5,800	6,800	11,300	11,000	2,900	3,100	(S)	(S)
Forestry and fisheries	7,900	8,900	(S)	(S)	(S)	(S)			(S)	(S)	(S)	(S)		
Mining	115,100	112,400	29,900	34,400	3,200	4,300	88,300	111,100	1,000	1,100	72,300	75,700	39,900	39,000
Metal	(S)	(S)	18,100	20,700	900	1,500	86,300	108,400						
Coal			(S)	(S)					(S)	(S)				
Crude petroleum and natural gas	95,800	91,700	(S)	(S)	(S)	(S)	(S)	(S)	(S)	(S)	72,300	75,700	39,500	38,600
Nonmetallic, except fuels	19,000	20,400	11,600	13,600	1,700	2,400	1,400	1,900	(S)	(S)	(S)	(S)	(S)	(S)
Contract construction	1,820,800	2,471,700	272,100	402,100	383,200	570,900	125,900	180,400	57,100	73,500	14,800	17,700	27,400	34,400
Manufacturing	9,739,200	12,442,900	641,200	839,900	1,007,900	1,521,800	113,000	158,300	193,900	275,300	17,900	27,900	61,900	97,600
Food and kindred products	531,200	618,700	34,900	42,300	61,100	80,900	8,200	10,900	15,800	18,700	1,300	1,600	(S)	(S)
Textile mill products	79,600	115,700	2,800	4,600	(S)	(S)			(S)	(S)				
Apparel and other fabric products	409,800	559,900	12,300	19,300	17,200	22,700	1,700	2,700	102,300	157,100	(S)	(S)	(S)	(S)
Lumber products and furniture	328,100	396,400	22,200	30,900	26,400	36,200	3,200	4,500	5,900	8,300	(S)	(S)	(S)	(S)
Paper and allied products	214,400	295,600	16,900	26,200	4,600	6,700	(S)	(S)	(S)	(S)				
Printing and publishing	562,900	774,600	32,100	46,500	55,900	87,700	13,100	20,300	8,500	12,100	1,500	2,100	1,800	2,500
Chemicals and allied products	420,500	602,600	25,300	34,000	8,600	13,800	900	1,000	1,600	2,000	(S)	(S)	32,600	54,300
Petroleum refining	252,300	291,700	(S)	(S)	1,200	1,600	(S)	(S)	7,700	9,200	900	1,100	2,400	2,800
Primary metals	307,800	360,600	163,200	197,100	48,300	63,400	(S)	(S)	24,200	29,700			(S)	(S)
Fabricated metals and ordnance	955,400	1,171,600	34,200	47,500	63,300	97,000	50,900	63,200	7,400	9,800	1,600	2,600	3,000	7,400
Machinery, excluding electrical	1,052,200	1,379,300	33,600	45,900	142,100	214,400	1,900	2,200	800	1,100	7,200	11,800	14,600	22,200
Electrical machinery and supplies	1,613,700	2,156,900	55,500	83,900	300,000	479,500	15,300	26,800	(S)	(S)	1,600	2,800	(S)	(S)
Motor vehicles and equipment	341,500	447,600	1,600	2,100	5,500	8,200	(S)	(S)	1,800	2,900				
Transportation equip., excl. mtr. vehs	1,485,800	1,604,500	125,400	148,000	145,700	201,300	2,300	3,100	(S)	(S)	(S)	(S)	(S)	(S)
Other manufacturing	1,183,300	1,666,600	80,200	110,500	127,100	207,600	14,700	22,500	16,600	22,400	2,400	3,800	3,100	5,200
Trans., comm. and public utilities	2,670,700	3,781,300	254,400	373,800	307,200	487,500	74,300	110,300	95,300	120,100	16,800	22,300	21,200	26,500
Railroad transportation	103,400	100,500	51,800	51,900	5,800	6,000	10,300	10,400	17,900	17,000	(S)	(S)	(S)	(S)
Trucking and warehousing	607,900	857,500	40,800	67,100	65,500	105,100	12,000	19,100	18,400	26,400	3,400	4,900	8,000	9,500
Other transportation and services	824,700	1,142,000	15,600	25,700	48,700	75,600	9,800	14,200	10,700	14,000	5,400	6,600	3,700	4,300
Communications	850,700	1,292,900	87,800	143,400	97,200	163,700	25,700	42,200	15,300	21,700	3,800	5,400	4,700	6,700
Utilities (elec., gas, sanitary)	283,700	388,300	58,200	85,400	89,800	136,900	16,400	24,100	32,800	40,900	4,100	5,200	4,200	5,500
Wholesale and retail trade	6,326,400	8,220,100	668,000	935,600	832,300	1,217,400	202,000	288,100	184,600	233,900	38,700	48,800	58,100	67,900
Finance, insurance and real estate	2,513,600	3,739,900	171,600	282,900	396,300	658,400	71,900	114,700	49,500	71,400	14,300	20,700	10,700	14,200
Services	7,994,600	11,609,400	812,200	1,329,100	931,000	1,590,300	283,000	463,900	149,100	222,700	52,100	73,500	41,100	57,300
Lodging places and personal services	451,500	530,500	74,200	91,400	106,900	149,600	29,200	38,000	14,300	16,800	3,600	3,800	3,800	4,000
Business and repair services	1,623,100	2,396,600	100,700	214,300	186,700	330,400	44,100	76,800	27,300	43,100	9,000	12,900	16,500	23,800
Amusement and recreation services	790,300	930,400	33,900	48,100	25,800	38,700	7,400	10,500	3,300	4,400	1,200	1,600	1,100	1,400
Private households	186,700	193,100	23,600	26,600	17,900	20,800	9,200	10,200	5,000	5,000	3,800	3,600	2,300	2,100
Professional services	4,942,800	7,558,700	549,600	948,600	593,600	1,050,600	193,000	328,200	99,000	153,100	34,300	51,400	17,200	25,800
Government	5,350,800	7,701,400	1,006,900	1,455,000	764,500	1,212,300	379,000	584,400	324,000	432,400	27,700	38,600	38,800	54,200
Federal government	941,000	1,324,500	180,500	246,400	127,900	196,400	67,800	109,300	90,600	124,000	3,600	4,800	2,300	3,000
State and local government	4,146,300	6,047,800	674,400	1,018,800	558,900	917,000	241,000	385,700	104,800	144,700	23,000	32,400	35,000	49,200
Federal military	263,400	329,000	152,000	189,800	77,600	98,800	70,100	89,300	128,600	163,700	1,000	1,300	1,400	1,800

Source: Area-Economic Projections 1990, U.S. Department of Commerce, 1976.

[a] S -- Too small to project.

other North Slope) crude oil to California, another oil company would propose use of the line for eastward-flowing crude oil.

Petroleum. Regardless of whether the proposed SOHIO project is implemented, consumption trends of petroleum products along the pipeline route would not be expected to change. The proposal is a transportation system and as such would not be expected to be a source of additional petroleum products west of Midland.

The projections and extrapolations shown in Table 2.2.16.5-1 were reviewed to establish petroleum demands in the year 2000.

Table 2.2.16.5-1

Petroleum Demand in PADD V, 2000 A.D.

PROJECTIONS, EXTRAPOLATIONS	Total PADD V Demand	
	Crude Oil Equivalent Mbbl/cd	Average Yearly Increase Percentage
Extrapolated 1995 Pace projection [a]	4,625	2.99 [b]
Rand projection (med prod./med use)	2,923	0.83
Rand projection (med prod./low use)	2,164	-0.38
Rand projection (low prod./high use)	5,332	3.29
Extrapolated 1975-1985 projection (Company A) [c]	3,933	2.21
Extrapolated 1975-1985 projection (Company B)	3,133	1.27
Population projection (Table 2.2.16.5.1-17)	3,603	1.68
Average of projections	3,794	1.70

Source: Robert Brown and Associates, 1976.

[a] Mainland portion of PADD V only.

[b] Based on 1974-1995 average rate.

[c] Extrapolated projection of product demand adjusted to crude necessary to produce product (private sources).

The projected yearly increase of approximately 3 percent projected by Pace, and in one case by Rand, is similar to the 3.1 percent projected by Kayfitz (1976) for the consumption of world resources during the same period. Such a rate of increase in the consumption of petroleum in PADD V is not probable for the following reasons:

1. The rate of increase of the middle-class consumptive population in the already affluent area will probably not equal that of the world as a whole.

2. It is not likely that environmental or economic factors will allow an increase of 1.9 times the 1975 consumption of petroleum in the PADD V area by the year 2000.

Since no substantial agreement was apparent between the projections reviewed, the average of 3,794,000 bbl/cd was used to approximate the total petroleum usage in PADD V in the year 2000. This average approximates that obtained by projection at the rate of expected population increase (Table 2.2.16.5-2).

Table 2.2.16.5-2

PADD V Population Projections

STATES	1975	1980	1990	2000
Washington	3,494,124	3,745,311	4,300,724	4,835,370
Oregon	2,299,000	2,496,982	2,835,968	3,020,208
California	21,206,000	22,659,000	26,098,000	29,277,000
Nevada	604,984	728,582	931,400	1,086,432
Arizona	2,245,000	2,828,200	4,076,500	5,770,500
Alaska	404,600	465,800	731,000	1,914,000
Hawaii	864,900	928,000	1,117,900	1,311,200
Total	31,118,608	33,851,875	40,091,492	47,214,810

Sources: State of Washington, Office of Program Planning and Fiscal Management, 1975; Center for Population Research and Census Projection, 1976 (Oregon); California Department of Finance, Population Projections for California Counties, 1975-2020; University of Nevada, Reno, Bureau of Business and Economic Research, 1975; Arizona Department of Economic Security, 1975; 1975 and 2000 -- University of Alaska, Institute of Socio-economic Government Research, 1975; 1980 and 1990 -- Review of Business and Economic Conditions, 1976; State of Hawaii, Research and Economic Division, Department of Planning and Economic Development, Population of Hawaii 1958 to 2025, Recent Trends and Projections, 1976.

The average of available crude supply projections, 3,948,000 bbl/cd was used to represent the consensus projection of total domestic West Coast crude supply in the year 1990. This projection includes approximately 150,000 bbl/cd of Elk Hills production. Elk Hills crude may not be available in 2000, however, having long since been shut-in.

Based upon the assumptions that Elk Hills crude will not be available in 2000 and that discoveries and declines will be about equal in the 1990 to 2000 period, a West Coast domestic crude production rate of 3,798,000 bbl/cd is estimated for the year 2000.

There is a consensus among forecasters regarding surplus PADD V oil. In general, they agree there will be a sizable surplus available for distribution to other parts of the United States.

1. Arthur D. Little (1976) estimates the surplus will be 689,000 bbl/cd in 1980 and 805 to 1,395 bbl/cd in 1985.

2. Williams Brothers Environmental Impact Assessment (1976) estimates a surplus of 300,000 to 600,000 bbl/cd in 1978 and 750,000 to 900,000 bbl/cd in 1982.

3. El Paso Natural Gas (1976) estimates a surplus of 400,000 bbl/cd in 1978.

4. Exxon (May, 1976) estimates a surplus of 697,000 bbl/cd in 1980 and 1,796,000 bbl/cd in 1985.

5. Rand Corporation (December, 1975) estimates that with medium use and medium use production care, surplus will be 320,000 bbl/cd in 1980 and 751,000 bbl/cd in 1985.

6. ARCO (June, 1974) estimates a surplus of 600,000 bbl/cd in 1980 and 850,000 bbl/cd in 1985.

Availability of crude by type. The availability of onshore California crude in the year 2000 was estimated to be 325,000 bbl/cd by applying a rate of decline of 2 percent per year for the period 1977 to 1987 and a rate of decline of 8 percent for the period of 1988 to 2000. The 2 percent rate in the first 10-year period is an estimate of a reduced depletion rate caused by secondary and tertiary recovery efforts. The 8 percent rate roughly represents the historical rate of decline in the recent past.

Total crude available to PADD V was estimated to be a total of 3,798,000 bbl/cd with California onshore providing 325,000 bbl/cd, Alaska providing 2,802,000 bbl/cd, and offshore providing 671,000 bbl/cd.

With one exception, no increase in capacity of Los Angeles Basin refineries beyond the projected 1977 installed capacity is believed to be possible in a projection to the year 2000 because of the serious air quality problems which already exist in the basin. Increased capacity has been projected beyond that developed for the 1977 case for the new Standard Oil fuel-oil facility. In this case, an additional capacity of 9,000 bbl/cd is projected for the year 2000 because of an increase in on-stream efficiency which is believed possible.

The Standard Oil Company of California has publicly stated that the design and intended crude for its new low-sulfur fuel oil production facilities is light Arabian crude. Actually it is not known whether or not the new Standard Oil facility could even successfully process North Slope crude at design rate. At this point, there is no universal agreement between residual fuel processing plant licensors that North Slope residuum can be processed with present technology.

For this reason the new Standard Oil Company of California low-sulfur fuel oil refineries in El Segundo and Richmond were projected to feed light Arabian crude oil in the year 2000 as was the assumed case for 1977. Based upon the previous availability and capacity projections, the crude slate for year 2000 for the Los Angeles Basin refineries and the remainder of the PADD V in an environment without the project was approximated to be as shown in Table 2.2.16.5-3

Table 2.2.16.5-3

Crude Slate for PADD V, 2000 A.D.[a]

CRUDE SOURCE	Los Angeles Basin Mbbl/cd	Rest of PADD V Mbbl/cd
California (onshore)[b]	237	88
Light Arabian[c]	151	151
Lube crude (south Alaskan)	-	100
Alaskan[d]	564	1,832
Offshore (domestic)[d]	205	466
Total[e]	1,157	2,637

[a] Based upon the availability of 3,798 Mbbl/cd domestic crude oil in an environment without the SOHIO project. Surplus of domestic crude oil is 306 Mbbl/cd.

[b] Based upon historical split of 73 percent to Los Angeles Basin refineries.

[c] To Standard Oil of California facilities.

[d] Prorated on basis of capacity.

[e] Overall crude rate based upon projection of crude oil demand of 3,794 Mbbl/cd in PADD V.

Demands for petroleum by type as percentage of the total demand are expected to change directionally between 1977 and 2000, as shown in Table 2.2.16.5-4.

Table 2.2.16.5-4

Product Changes Between 1977 and 2000 A.D.

PRODUCT TYPE	Demand Change	Reason
Motor gasoline	Down	Small cars Mass transit Shift to diesel power
Diesel fuel	Up	Diesel-powered transportation Increased utilization of railroads
Fuel oils	Up (somewhat)	Replacement of natural gas

Source: Robert Brown and Associates, 1976

Motor gasoline consumption, as a proportion of total product consumption in the Los Angeles Basin, while somewhat reduced, will still represent a greater proportion of the product slate than in the rest of PADD V due to the nature of an extensive suburban population. In addition, the desire to utilize the existing gas-oil conversion and gasoline reforming facilites of existing Los Angeles Basin refineries will maintain a product slate higher in gasoline proportion than the average of PADD V. Additional refining capacity, at a distance from the Los Angeles Basin, will be designed for the specific product demands not within the capacity of the Los Angeles Basin refineries.

The production of petrochemicals in the Los Angeles Basin is not expected to increase because of environmental considerations.

With these considerations in mind and with the added probability of product imports into the area (domestic and foreign) to supply unfilled product demands, only minor changes were made to the liquid product slate developed for the Base 1977 case (Table 2.2.16.5-5).

Table 2.2.16.5-5

Product Slates in the Los Angeles Basin, 1977 and 2000

PRODUCT TYPE	Base 1977 (percent)	Base 2000 (percent)
LPG and other	4.9	7.9
Gasoline and jet	47.8	44.5
Mid-barrel	20.4	25.6
Fuel oil (net)	26.9	22.4

Source: Robert Brown and Associates, 1976.

All residual fuel oil was desulfurized to 0.5 percent sulfur. No market for fuel oil of higher sulfur content is anticipated for the year 2000. While some doubt currently exists in regard to the ability to desulfurize the residual from Alaskan crude, it was assumed that advances in desulfurization technology would allow such processing. Additional reduction in the sulfur content of residual fuel was not considered to be technically feasible. All mid-barrel products were desulfurized to 0.5 percent or less sulfur content. The hydrogen sulfide content of refinery gases produced and burned as refinery fuel was assumed to be reduced to the EPA's New Source Standard level of 10 grains per 100 cubic feet. Motor gasoline will be blended to a maximum vapor pressure of about 7.0 psi in light of probable regulations restricting gasoline vapor pressure. This reduction in vapor pressure will cause a reduction in gasoline production of about 24,000 bbl/cd in the Los Angeles Basin.

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